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Increasing Chlamydia Screening in the High-Risk Population using Electronic Notification and Targeted Education: A Primary Care Approach

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Abstract

The primary care office is an ideal setting and the front gate for screening young adults for chlamydia infection. Chlamydia is the most common sexually transmitted infection in the US and sexually active women aged 24 and younger are at the highest risk for having it (Centers for Disease Control and Prevention [CDC], 2016). Screening is simple and effective and can be completed through a urine test. Treatment is straightforward and involves a one-time dose of antibiotic medicine. Untreated infections in women can lead to pelvic inflammatory disease (PID), chronic pelvic pain, infertility, and life-threatening ectopic pregnancies (Papp, Schachter, Gaydos, & Pol, 2014). Despite the simplicity of managing this specific sexually transmitted infections, screening occurs in only about half of these women (CDC, 2013). The advent of the electronic medical record (EMR) has helped to improve healthcare, for example medication errors have drastically improved (The Office of the National Coordinator for Health Information Technology, (ONC), 2019). For my DNP project, I leveraged the technologic potential of the EMR's in order to improve chlamydia screening. This technology stands to identify more infections and earlier, facilitate prompt treatment with a simple and cheap medication, improve the quality of lives of US citizens, and preserve precious healthcare resources by reducing the incidence of chronic conditions.

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Problem Description

Chlamydia is the most common sexually transmitted infection reported in the United States and it is estimated that 1 in every 20 sexually active females aged 13 to 24 is infected (Torrone, Papp, Weinstock, & Centers for Disease Control and Prevention, [CDC], 2014). Chlamydia is a bacterial infection that is often asymptomatic, thus most of those infected are unaware and do not seek treatment, while being able to spread it silently. In 2012 there were more than 1.4 million cases that were reported to the CDC, however, because most infections are asymptomatic the true incidence is hard to accurately estimate (Centers for Disease Control and Prevention, 2015). There is a disproportionate amount of infection in minorities as well as those in low socioeconomic status (Owusu-Edusei, Chesson, Leichliter, Kent, & Aral, 2013). Untreated infections in women can lead to pelvic inflammatory disease, chronic pelvic pain, infertility, and life-threatening ectopic pregnancies (Papp, Schachter, Gaydos, & Pol, 2014).

People between the ages of 13 and 24 years old are considered to be in adolescence and early adulthood. This period of life includes physical, psychological, cognitive, emotional, social, sexual, and identity development within the framework of social expectations, change, and increased risk-taking (Jaworska & MacQueen, 2015). Behaviorally, adolescents are more likely to engage in high-risk sexual behavior such as concurrent sex partners or sex without a condom. This is due in part to the fact that the prefrontal cortex, responsible for executive function, is still developing through adolescence (Shannon & Klausner, 2018). Furthermore, experts in the field of adolescent health have long recognized that many of the greatest threats to health and wellness for this population occurs as a result of risky behaviors, including unsafe sex (resulting in high rates of unplanned pregnancies as well as sexual transmitted disease) (Bitzer, Sultan, Creatsas, & Palacios, 2014). Early adulthood is the transition period between adolescence

and adulthood and is important as it sets the stage for later adult life. Young adults (aged 19 to 24) often develop healthy lifestyles but are not risk-free. Identified risks include the use of alcohol, tobacco, and drugs (and driving under the influence) and risky sexual behavior persists from adolescence and even peaks in this age period (Scales et al., 2015). This results in males and females, aged 24 years old and younger, being at an increased risk for acquiring chlamydia.

The United States Preventive Services Task Force (USPSTF) is an independent group of national experts who research and develop recommendations for clinical preventive services. Their mission is to provide evidence-based recommendations on preventive services to primary care physicians who deliver preventive care (Krist, Bibbins-Domingo, Wolff, & Mabry-Hernandez, 2018). One of the recommendations put forth by the USPSTF is to perform annual chlamydia screening for all sexually active females aged 24 and younger (USPSTF, 2014). Several other professional organizations have developed and endorse similar screening guidelines (Table 1). Based on these recommendation Medicare, Medicaid, and private health insurance plans cover the cost of screening and treatment without cost-sharing (CDC, 2020).

Table 1 - Recommendations for Chlamydia Screening

Organization	Recommendations
United States Preventive Services Task Force	Screen annually for all sexually active females aged 24 years and younger
The Centers for Disease Control and Prevention	Screen annually for all sexually active females aged 25 years or younger
American Academy of Family Physicians	Screen annually for all sexually active females aged 24 years and younger
American College of Obstetricians and Gynecologists	Screen annually for women younger than 25
American Academy of Pediatrics	Screen annually for women younger than 25

According to the American Academy of Family Physicians (AAFP), primary care practice provides health promotion, disease prevention, health maintenance, counseling, patient education, diagnosis and treatment of acute and chronic illnesses within a variety of care settings

(American Academy of Family Physicians, 2020). Despite primary care being the responsible and optimal setting, effective patient screening for targeted populations can be challenging within a busy primary care setting. Primary care appointments are typically 15 minutes in duration, and the majority of appointment include either a chronic condition or a new complaint (CDC, 2019). Insurance data from 2014 reflects this challenge showing that only 47% of sexually active women under the age of 24 with commercial health insurance and about 55% with Medicaid were screened for chlamydia (CDC, 2013).

Native American Health Center (NAHC) is a Federally Qualified Health Center (FQHC) located in the Fruitvale area of Oakland, California. An FQHC is a community-based organization that provides comprehensive primary and preventative care, including health, oral, and mental health/substance abuse services to all people regardless of health insurance status or ability to pay (Rural Health Information Hub, 2019). The FQHC is considered a critical component of the health care safety net and functions to provide services to underserved populations. Native American Health Center is a primary care outpatient community clinic that serves a diverse urban population. This population consists of: 21% Native American, 20% African American, 47% Latino, 12% Euro American, 9% Asian/Pacific Islander, and 1% unknown (Native American Health Center, 2010). The languages spoken at the clinic include English, Spanish, Mam, Chinese, and Tongan.

A needs assessment was performed at NAHC in May 2019 with chlamydia screening rates being evaluated for the years of 2018 to 2019. Screening rates for this high-risk and underserved population of sexually active females aged 24 and younger was found to be 14%, whereas the national average based on Medicare data in this population is 55%. A GAP analysis reveals three areas where the current state of the organization does not reflect best practice.

First, staff knowledge and confidence regarding interaction with patients around the topic of chlamydia screening is questionable and there is lack of evidence that periodic education on screening guidelines, symptoms, treatment, and common questions is being provided. Best practice would involve periodic education for staff members to raise awareness and knowledge. A solution to this gap would be to develop and provide an education module for staff to teach, reinforce, and update knowledge regarding aspects of care surrounding screening and treatment. Second, there are cultural and educational barriers with patients on effective chlamydia screening in the clinical setting. Best practice would be for staff to effectively communicate and educate, answers questions about, and recommend annual screening to high-risk patients. A solution to this gap involves creating a survey to assess staff knowledge and confidence surrounding the topic of chlamydia, and to conduct a secondary post-education survey to reassess staff knowledge and confidence after the educational content has been provided. Finally, there is an absence of any formal system to remind providers of high-risk populations and frequency for chlamydia screening. Best practice includes the availability of a convenient and accessible reminder system for staff to reference and identify high-risk populations as well as chlamydia screening guidelines. A solution for this gap involves the initiation of an electronic notification/reminder system to alert providers when clinic patients are considered high-risk and due for chlamydia screening. The aim of this project, referred to as the Chlamydia Screening Improvement Project (CSIP), is to improve screening rates for chlamydia infection within a primary care setting, by implementation of an electronic notification system and education-based protocol, for the high-risk patient population of sexually active females aged 24 years old and younger.

Available Knowledge

The search inquiry was completed utilizing the electronic medical databases PubMed, CINAHL Complete, Scopus, and included the keywords "chlamydia", "screening", and "primary care". Inclusion criteria were set to include only research conducted over the past 10 years (June 2010 through June 2020), English-language studies, peer-reviewed journals, and article types that included systematic reviews, randomized controlled trials, and reviews. The search was conducted using the described keywords with appropriate filters yielded 301 articles. Articles whose title and abstract were based on retesting after infection and treatment, partner notification, protocols for screening, opportunistic testing, qualitative-based articles, testing in the home or Emergency Departments setting, or whose focus was on men or transgender were excluded. Secondary review included the reference lists in articles that met search criteria. Furthermore, guidelines for chlamydia screening were reviewed through a general internet search of qualifying organizations. The Johns Hopkins Nursing Evidence-Based Practice Evidence Appraisal Tool (JHNEBP) was utilized to ascertain clinical relevance and validity. Seven articles were identified for the following review of evidence and a summary of these articles are provided in evaluation table format (Appendix C).

Keegan, Dledrich, & Pelpert (2014) conducted a meta-analysis that evaluated screening recommendations, screening tests, barriers to screening, and management for chlamydia infection. There were two randomized controlled trials reviewed in this meta-analysis that supported annual chlamydia screening. The first looked at high-risk women in Seattle and found that the risk of pelvic inflammatory disease (PID) was reduced by 50% in women who completed screening, and treatment, if necessary, within a one-year period. The other looked at high school students in Denmark who were mailed information on chlamydia, and encouraged to

visit their physician for free screening. This intervention was associated with a 50% reduced risk of PID (4.2% vs. 2.1%, P = 0.045) at one year. Keegan, Dledrich, & Pelpert (2014) noted that based on these two studies, in 2007 the US Preventative Services Task Force (USPSTF) recommended annual chlamydia screening for all sexually active non-pregnant females aged 24 and younger. There are different methods to test for chlamydia infection. It was noted that cell culture was once the gold standard in identification based on its superior specificity, however, the current standard diagnostic and screening test has changed to nucleic acid amplification test (NAATs). The use of NAATs has superior sensitivity and specificity while allowing for additional screening options, such as urine collection and vaginal swab. The vaginal swab method of testing had the highest sensitivity (86% and 97.2%), is the most preferred by patients, and is now the CDC recommendation for testing method (Keegan, Dledrich, & Pelpert (2014). While screening rates have increased over the years, potentially due to the development of NAAT allowing for urine or vaginal swab testing, a large portion of women are still not being screened.

Barriers to screening were evaluated by Keegan, Dledrich, & Pelpert (2014) and for providers barriers identified included being a male provider, having the perception that chlamydia prevalence was low, being a solo practitioner, practicing in a rural setting, and practicing in an area with few minority patients. This meta-analysis found that a combination of educational outreach and financial incentive increased practitioner's involvement with chlamydia screening and led to a significant increase in the number of tests performed. For patients, barriers to screening included a lack of knowledge related to its asymptomatic nature, possible long-term morbidity of infection, as well as stigma related to screening and receiving a positive diagnosis. Furthermore, it was found that patients who were minority race/ethnicity, low socio-

economic status, and lack of insurance had decreased screening. Mail-based chlamydia information with a mail-back sampling kit were 2 to 3 times more likely to be diagnosed and treated for chlamydia than those receiving the usual standard of care. Also, the advent of NAAT testing has allowed for alternative testing options (i.e. urine and vaginal swab), which was found to be much more comfortable for patients, allowed for self-collection, and can be done either at home or in the clinic.

Treatment of infection was evaluated by Keegan, Dledrich, & Pelpert (2014) and looked at treatment from a medication as well as a partner-treatment standpoint. It found that both azithromycin and doxycycline have comparable cure rates. While azithromycin is a one-time oral treatment, doxycycline requires pills to be taken twice daily for 7 days. Based on the concern that many patients may not complete all seven days of a course of doxycycline, the CDC recommends the use of 1 gram of azithromycin orally in a single dose (CDC, 2016). Alternative treatments with erythromycin or fluoroquinolones are available for patients who are allergic to, or unable to tolerate, preferred treatment. A thorough sexual history should be performed on all patients screening positive for chlamydia and when the patient receives a prescription for treatment, additional medication should be provided for treatment of all sexual contacts within the preceding 60 days. The provision for providing additional prescriptions and medication instructions for patients to give to their sexual partners without requiring them to be seen by a physician is the cornerstone of Expedited Partner Therapy (EPT). Currently, the use of EPT is legal in the state of California and may be provided by physicians, nurse practitioners, certified midwives, and physician assistants (CDC, 2007). Reinfection is very common, for reasons including re-infection from untreated partners, infection from subsequent partners, persistent infection, and failure to complete treatment (Heijne, Althaus, Herzog, Kretzschmar, & Low,

2011). It is recommended by Keegan, Dledrich, & Pelpert (2014) that patients testing positive be retested in 3 months to ensure the infection is cleared.

The strengths of the study by Keegan, Dledrich, & Pelpert (2014) include the review of randomized controlled trials and meta-analysis, as well as linking data to recommendations made by CDC and the USPSTF. It considered all major aspects of chlamydia from a primary care standpoint as well as highlighting key recommendations to improve screening. Unfortunately, the study does not expand on barriers to screening and the recommendations for financially incentivizing providers to enhance screening is not always feasible in areas serving low socio-economic and minority populations.

Interventions to increase rates for chlamydia screening in primary care were evaluated by Guy et al. (2011) in a systematic review. In total there were 16 interventions with 15 of them targeting females. Of these 15 interventions for females, 6 were associated with statistically significant increases in chlamydia screening rates. The 6 interventions included 1) a multi-faceted quality improvement program that included urine collection from all patients at registration, 2) linking screening to routine PAP smears, 3) computer notification system for doctors, 4) education workshop for clinical staff, 5) internet based continuing medical education, and 6) offering free sexual health consultations to patients. The multi-faceted quality improvement program included a 4-stage clinical improvement initiative which included capacity building, development of a clinic flow-chart, monthly meetings to identify screening barriers and strategies to overcome them, development of performance indicators, and a universal urine specimen collection from all patients included in the program at the time of registration. This quality improvement program demonstrated an improvement in screening rates from 21% to 65% with effects that were sustainable for 18 months and shows that a multi-

faceted approach to improving chlamydia screening rates can be effective. The second intervention included linking chlamydia screening to PAP smears in a randomized controlled trial in Australia resulted in a small but significant increase in screening from 4.5% to 6.9%. The third intervention included the use of a computer notification for physicians, was based on a randomized controlled trial in Australia, and the results demonstrated an increase in chlamydia screening from 10.6% to 12.2%. The fourth intervention was based on an education workshop for staff and resulted in a 33% increase in screening rates with effects that lasted for 10 months. The fifth intervention was based on continuing medical education for physicians which results in an increase in chlamydia screening rates from 12.4% to 15.5%. The sixth intervention involved offering free sexual health consultations to patients in New Zealand and this intervention resulted in increased screening rates from 13.2% to 16.8%. Each of these six interventions demonstrated statistically significant improvement to chlamydia screening and can be helpful in identifying solutions for increasing chlamydia screening.

Strengths of the study included the focus on evaluating interventions aimed at improving chlamydia screening rates and included a review of high quality RCTs with large patient populations (Guy et al., 2011). Also, cost and complexity of implementation were not exclusion criteria, thus many different types of interventions were reviewed. Of note, two of the interventions reviewed in this study (computer notification and education workshop for clinical staff) are components within this quality improvement project. Limitations of the study include the lack of screening for a specific high-risk population (sexually active females aged 24 and younger), the linking of chlamydia screening to PAP smears excludes females under 20 who are ineligible for PAP smears. It was also noted that the development of an interactive workshop for

staff education would require significant staff resources and would be challenging to roll out on a large scale.

McDonagh and colleagues (2018) completed a systematic review to identify barriers and facilitators to chlamydia testing for young people as well as providers within a primary care setting. Thirty-nine papers met the review's inclusion criteria with 14 focusing on patients and 25 focusing on providers. The Capability, Opportunity, and Motivational model of behavior (COM-B) was used to identify the facilitators and barriers for chlamydia screening. Barriers and facilitators were identified at the patient, provider, and service level. This review helped clarify the complexity of chlamydia testing behavior while also providing guidance on how to improve chlamydia testing within a primary care setting.

Barriers to care limit or prevent people from receiving good quality health care. Several barriers to chlamydia screening were identified and broke down by patient, provider, or facility by McDonagh and colleagues (2018). For patients, barriers include a lack of education/knowledge/awareness, beliefs regarding risks, embarrassment, fear of receiving a positive result, and stigma. For providers, barriers include a lack of training and skills, knowledge and awareness, forgetfulness, the perception of patients, the challenge of discussing screening, and effects on the doctor/patient relationship. For facilities, barriers include lack of practice nurse involvement, lack of testing guidance, unattainable targets, time-constraint, testing based on behavior, costs of testing, and testing policy/cultural norms.

Facilitators are things that provide support to individuals or groups of people in order to achieve beneficial change. McDonagh and colleagues (2018) also identified several facilitators to chlamydia screening and broke them out by patient, provider, or facility. For patients, facilitators include increasing knowledge/education/awareness, the belief that testing was

responsible/mature/healthy, worries of an asymptomatic infection, and easy availability for testing. For providers, facilitators include skills-based training, increasing knowledge/awareness/education, increasing confidence, modes of testing, and the consultation context. For facilities, facilitators include involving practice nurses, prompts and reminders, reward and incentive programs, feedback on efforts, promotional material, and testing policy.

McDonagh and colleagues (2018) highlight the complex nature of screening for chlamydia within the primary care setting. Time limitation was identified as a barrier that spanned the patient, the provider, as well as the facility. Standard primary care doctor appointments can be as short as 15 minutes in length, covering primary complaints, management of chronic conditions, and all health maintenance which can severely limit the amount of time available to discuss chlamydia screening. Normalization was a component found to be a facilitator that also spanned the patient, provider, and facility. Other components were found to be both a barrier and facilitator. The involvement of reception staff could improve screening by addressing workload and time constraints, but at the same time they are ill-equipped to answer questions and patients found the reception area unacceptable for initiating testing. Themes that emerged from the study included the need to normalize testing as universal and to embed it within routines, preserve patient privacy regarding sexual history and screening, address time-constraints, and offer testing in a context that addresses potential stigma. Other aspects were found to be more directly related. Lack of provider training and knowledge were associated with less confidence in conducting screening. Forgetfulness was related to a lack of a reminder system. Finally, patient's perceived risk was mediated through awareness and education on chlamydia.

Strengths of the review by McDonagh and colleagues (2018) include its comprehensive analysis of multi-level as well as theoretical barriers and facilitators associated with chlamydia screening. By implementing clinic-based interventions that overcome barriers or leverage facilitators, projects designed to improve chlamydia screening stand a much higher chance of success. It is also based on the COM-B model which develops a framework for evaluating and explaining chlamydia testing within the primary care setting and can serve as a foundation for future interventions. Limitations of this review include the lack of background, demographics, or testing patterns of the providers or facilities, which would have provided context for the input of staff. Also, patients in this review may or may not have been offered chlamydia test, and if they had, it could have been in any setting. Therefore, feelings and input at the time of interview may not represent what would actually happen if they were offered a test at their primary care clinic.

Wong et al. (2019) conducted a systematic review evaluating interventions used to improve chlamydia screening; assessing effectiveness while also evaluating variabilities within the interventions which can make it difficult to determine effectiveness. The socioecological model was used to organize interventions, including classifications for individual, interpersonal, organizational, community, and policy. At the level of the individual and interpersonal, results demonstrate that providing home-based chlamydia screening tests was an effective solution to increase screening but identified its cost-effectiveness as a potential barrier to success and requiring further research. At the organizational level interventions were further broken down into low-cost (<$1,000), moderate-cost ($1,000 to $10,000) and high-cost (>$10,000). Effective low-cost interventions included strategic collection cup placement, routine collection during consultations, and use of an electronic health record notification. Moderate-cost interventions

that were found to be effective included use of postcards and telephone calls. High-cost interventions found effective were based on dedicated staff screening and offering free sexual health consultations. Challenges for implementing effective solution at the organizational level include the lack of protocols for obtaining urine samples, insufficient knowledge about chlamydia and urine-based tests, and reluctance of staff to engage in screening adolescents for sexually transmitted infections. At a community level this review found that screening within a juvenile detention/correctional facility, or an educational setting is an effective method for screening within high prevalence settings. It found that outreach programs may achieve high participation rates but suffer from limited reach, and that the most effective solutions are mostly not publicly available. At the policy level this review identified that providing education, either through an educational package, a health advisor to increase awareness and train staff, or an internet-based medical education program, was an effective method of increasing chlamydia screening while noting that for a variety of reasons many clinicians are hesitant to screen sexually active asymptomatic female patients.

CSIP was able to leverage research from the Wong et al. (2019) review demonstrating that use of an electronic health record notification system is an effective and cost-efficient solution for increasing rates of chlamydia screening. Recommendations for an educational package for practitioners and the use of internet-based education can help to improve knowledge and confidence regarding chlamydia were incorporated into the project and may also serve to address concerns brought up in the review identifying insufficient knowledge about chlamydia for the individual patient as knowledgeable staff members may be able to field questions and educate patients. Future research would benefit from further evaluating home testing kits in

order to determine when cost becomes effective and to further evaluate the impact use of a home-testing kit can have on chlamydia screening rates.

McNulty et al. (2013) conducted a prospective cluster randomized control trial to evaluate if a structured complex intervention increased chlamydia screening rates in a primary care setting. Randomizing can be difficult to conceal when evaluating an educational component, thus a modified Zelen design was used and overcomes this concern by not informing any participants they are in a trial. The multifaceted complex intervention is based on a cognitive theory such as the theory of Planned Behavior which has been demonstrated as effective to help change behavior. This RCT targeted patients aged 15 to 24 years old and involved 160 primary care offices: with 80 in the intervention group and 80 in the control group.

The intervention was broken down into different components to address aspects of the theory of planned behavior such as changing personal attitudes, subjective norms, and behavior controls. In the area of changing personal attitudes, interventions included a workshop showing how common chlamydia is and the benefits of testing asymptomatic populations, develop testing targets, provide feedback/champions/screening performance through monthly newsletters, providing a certificate of training as well as a certificate of personal development. In establishing subjective norms interventions included an invitation for all staff to participate in the workshop, providing posters for the clinic that state “WE are a chlamydia screening practice”, facilitating teamwork through inclusion of chlamydia testing as a standing agenda in practice meetings, the publishing of a monthly newsletter providing information on screening rates, and adding a pop-up reminder for targeted population in order to normalize the offer. In the area of behavioral controls, interventions included a workshop with protected learning time to improve staff knowledge and inspire self-confidence to offer screening, registration to provide invitation

cards for patients to ask for screening, adding chlamydia screening to order templates for different consultations such as (i.e. contraception/asthma/travel/etc), and to offer a web-based education module to allow those who cannot make the workshop to still undertake training and receive a certificate. The use of this complex intervention led to an overall 76% increase in chlamydia screening across all practices who received the intervention as compared to those that did not use the intervention. Absolute testing rates for 15- to 24-year-old patients increased from 2.43 to 4.34 per 100 patients in the intervention group compared with controls that increased from 2.61 to 3.00 per 100 patients, unadjusted ratio 1.66 (CI 1.1 to 2.5). In the 34 practices that utilized electronic notifications as part of their intervention results demonstrated the testing rate was 2.81 times as great as in the control group (RR 2.81, 95% CI 1.91 to 4.13, $p<0.001$).

Results from the RCT by McNulty et al. (2013) support the idea that CSIP can see improvement in screening rates through use of education and electronic notification. A strength of the study was that it was a randomized control trial, which evaluated and demonstrated a significant improvement in screening rates through use of electronic notification system. In evaluating this data for use in CSIP, a weakness in the trial was that the education was integrated into the complex intervention in such a way that it became challenging to extract the degree to which the education component affected screening rates as compared to, for example, the posters that state “WE are a chlamydia screening practice”. As the only aspect of the intervention reporting detailed data was the electronic notification, moving forward it would be beneficial to parse out how much of an impact each portion of the complex intervention had on the outcome measure.

Karas et al. (2018) conducted a retrospective review evaluating the impact of pop-up alerts and education on chlamydia screening rates in female patients aged 13 to 21 years old who

are presenting for preventative care. The review was conducted across a large network of 27 pediatric primary care offices that serve urban, suburban, and rural areas within the US. The intervention was based on a clinical decision support (CDS) which is considered to be a process of enhancing health-related decisions and actions with pertinent, organized clinical knowledge and patient information to improve both health and healthcare delivery. This is part of the CDS 5 Rights framework which asserts that interventions must provide the right information, to the right people, via the right channels, in the right format, and at the right point in the workflow. The primary goal of the intervention was to increase chlamydia screening rates in sexually active high-risk females. Secondary goals included increasing provider awareness of screening guidelines, incorporating CDS with appropriate treatment, and provide recommendations for follow-up.

The intervention was incorporated in the EPIC electronic medical record system. When the patient chart was opened in EPIC it would scan the patient's health record for any indication of sexual activity, including sexually-related diagnosis in the problem list, indication of sexually activity in the social history, or mention of sexual activity in the history of presenting illness. EPIC would then scan for a screening order within the prior year and if it did not exist EPIC would activate an alert that the patient was a candidate from screening. The provider then had the option to open an order set that contained appropriate screening labs and billing diagnosis. In conjunction with the pop-up, this intervention also provided an educational component which included 2 presentations by an adolescent medicine specialist and a quarterly newsletter distributed to the medical offices for 2 years. Rates for screening in the year prior the intervention were at 2.4% and increased to 5.01% in the year after the intervention ($p<0.01$). Overall, the proportion of screened patients before and after the intervention was statistically

different (OR=2.143, 95% CI 1.833 to 2.504), which means the odds of a sexually active female being screened after the intervention was 2.143 times higher than before the intervention.

This review and intervention are very similar in structure to CSIP and the results support the likelihood of success with CSIP. A strength of the review is that the pop-up notification provided an easy link to opening an order set which conveniently provides the correct screening test as well as adjunct order (i.e., retest in 3 months) for the provider to acknowledge. This saves additional time, increases convenience, and decreases the chances of an incorrect or missed screening order. CSIP did not include this and future QI project would benefit from including this and evaluating how it impacts screening rates. Also, the use of a quarterly newsletter improves awareness of chlamydia screening for providers within the office but it's effects might be best utilized in a setting with multiple offices. The use of an adolescent specialist to provide education could be seen as a strength but in the setting of Covid, where remote access education was necessary, the benefit of using a specialist capable of answering questions and giving more in-depth information and richer context was not possible.

Ursa, Greenberg, & McKee (2019) conducted a case study looking at the use of Plan-Do-Check-Adjust (PDCA) as a framework for quality improvement to improve chlamydia screening in women aged 16 to 24 years old. The use of chlamydia screening was used because of the health burden that the infection poses, the availability of non-invasive screening tests, success of treatment and the institution's low rates screening which needed improvement. The project was a multidisciplinary collaboration (i.e., family medicine, internal medicine, pediatrics, obstetrics and gynecology, and the University Health Service) within the University of Michigan Health System, which is an academic institution in the Midwest United States over a 1-year period. The intervention included a workflow review, educational material, and clinical decision support tool

that was integrated into the Electronic Medical Record (EMR) system. Data collection included outputs from the EMR as well as interviews with clinicians and staff to understand the current state and challenges of chlamydia screening. The PDCA process for workflow review involves nine-steps which include 1) Assemble the team, 2) Identify the problem, 3) Prepare, 4) Set a goal, 5) Identify barriers, 6) Develop a solution, 7) Pilot, 8) Large scale rollout, and 9) Assess and modify. The educational material was created for staff, patients, and parents and explained the importance of screening, the process of screening, and how notifications of results and treatment works. The clinical decision support tool consisted of an alert that displayed in an area of the EMR called "best practice advisories". Screening rates for this population was at 29% and results of this QI project demonstrated that after 1-year rates of screening had increased to 60%.

This project incorporated electronic notifications through the use EPIC and notifications were placed in an area called "best practice advisories", which is the same EMR and implementation method used in CSIP, with similar outcomes. A weakness of this case study was the lack of detailed information on the educational component. Research has demonstrated that education is effective raising awareness, increasing knowledge, and inspiring confidence. Thus, it is likely that the educational component of this intervention was instrumental in the results demonstrated. Future studies would benefit from a more detailed review of the education in order to see how details of setting, content and delivery can affect project outcomes.

PICOT Question

For sexually active females aged 24 and younger, does use of an electronic notification system with targeted education improve screening rates for chlamydia, as opposed to the standard care model, over a one-year period.

Rationale / Framework

Despite strong recommendations from several professional organizations, advances in readily available knowledge (i.e. internet) for the general public, as well as government funding to cover the costs of screening and treatment for those in underserved and low socio-economic communities, overall rates for chlamydia screening remains low. Research demonstrates there are important gaps in patient knowledge, self-reported practices in primary care providers, time constraints, and the lack of a formal reminder system may contribute to low chlamydia testing rates and suboptimal management of infection (Lorch et al., 2013). By implementing CSIP, that leverages technological advances in combination with education supported by Kotter's change management model, identified gaps can be filled to improve the health and wellness of a population that represents the next generation of mothers. Sexually active adolescent females living in underserved and low socio-economic communities have unique and multi-faced challenges with maintaining health and wellness. Members of this target population are typically unaware of the possibility or risk of an asymptomatic infection. This lack of awareness can lead to lifelong sequalae and place a large burden on the healthcare system and society in general. The goal with CSIP is to improve chlamydia screening within an underserved population, resulting in increased health and wellness within the community.

Managers in today's healthcare system are in an extremely challenging position as they strive to maintain a competitive edge while leading the organization through constant change.

Kotter's change management model can be utilized for this project and is based on a dynamic, non-linear 8-step approach to implementing change. This model includes 1) increasing urgency, 2) build guiding teams, 3) get the vision right, 4) communicate for buy-in, 5) enable action, 6) create short-term wins, 7) don't let up, and 8) make it stick. This is not a step-by-step method for managing change but, instead is an iterative model that relies on the skills and knowledge of the manager who is bringing about change. For example, the manager may create a series of short-term wins in order to build guiding teams. During periods of change managers must deal with staff emotions that can work to undermine attempts at promoting change. Kotter's model provides tools to turn negative feelings into positive proactive feelings such as faith, trust, optimism, urgency, reality-based pride, passion, excitement, hope, and enthusiasm – which are emotions that promote change (Campbell, 2020). Kotter's change management model is being used to address anticipated team resistance to change and to support implementation of this project.

AIM Statement

The Chlamydia Screening Improvement Project (CSIP) aims to increase the chlamydia screening rate at a federally qualified healthcare center in California, from a baseline of 14% to 60% in sexually active females aged 24 and younger over a 12-month period. CSIP will utilize an electronic notification system within the EMR, aim to increase staff awareness, provide staff education to increase confidence, and develop a feedback system to facilitate improvement.

Context

A needs assessment was completed at a federally qualified healthcare center (FQHC) in California hosting 12 providers and evaluated chlamydia screening rates for the high-risk

populations of females aged 13 to 24 years old. For the year 2019 screening rates for chlamydia were found to be 14%. Stakeholders were contacted and verbalized readiness in supporting practice change. This project leveraged research that shows a multi-faceted approach may be effective, including medical alerts reminding providers, targeted education for the providers, as well as medical assistants to help overcome barriers related to provider lack of time and capacity (Kong et al., 2011). Previously, the FQHC site functioned with an older electronic medical record system (Cerner®) but, this older system did not include provisions for notification or reminders. The electronic medical record system changed to EPIC® in May 2019 and provision were included that allowed for configurable notification reminders.

Major stakeholders in this project included the patient, care provider, medical assistant, and management team within the FQHC. Patients have a pivotal role within the project as their care is being affected and enhanced through implementation of the project. The FQHC serves an area of California with one of the lowest public safety opportunity indexes, lowest life expectancies, and a higher-than-average percentage of low socio-economic and minority population (Haley, Zimmerman, Woolf, & Evans, 2012). High risk patients who are unaware of an asymptomatic infection can be identified and treated resulting in improved health and wellness. Care providers include the medical doctors as well as nurse practitioners, and they are responsible for managing primary care to the patient population. CSIP affects them directly as they received the intervention of the project, and subsequently provide the necessary orders to screen this patient population. Medical assistants are front line workers in this FQHC site and are involved with the many aspects of patient care. As it relates to this project, they provided the chlamydia testing kit to the patient as well as education on how to prepare and

provide the test sample. The management team at this FQHC is responsible for developing and maintaining policies within the organization. In addition, they also drive expectations, meet company goals, maintain financial responsibility, and improving operations within the organization. CSIP stands to impact the management team by improving screening benchmarks, financial reimbursement, and performance metrics within the organization.

Proposed Intervention

CSIP is a multi-faceted quality improvement protocol targeting the screening of sexually active females aged 24 years old and younger within the primary care setting of an FQHC in California. The project includes education, inclusion of an electronic notification system, and establishment of appropriate follow-up.

Education is vital to the success of the project and supports facilitating change within the organization. The educational component of this protocol included a PowerPoint presentation that disseminated relevant information to key stakeholders of the healthcare team, including current screening rates, prevalence of asymptomatic infection, risks of untreated infection, nature of the planned intervention, testing methods, project goals, and important information to be shared with patients. Key stakeholders receiving the education would include the management team, treating providers, and medical assistants. Opportunities were planned during education to illicit questions, concerns, and feedback on the information and project plan. Additionally, the education component of the project was planned to be recorded and made available as a video to all employees to view. By doing this we intended to help ensure all stakeholders were privy to the education component regardless of location, schedule, or availability. The education component was intended to not only educate, but also to engage and establish urgency with key

stakeholders of the healthcare team. The educational component helps increase the likelihood of successful project implementation by way of key stakeholder participation and buy-in.

The inclusion of an electronic notification system was the functional change driving the project. By adding an electronic notification system, busy care providers were reminded that chlamydia screening is recommended for this patient, and it occurs upon opening the patient's electronic medical record. This allowed providers to minimize distractions regarding comprehensive care and focus on chief complaint. A benefit of this notification system was that, in addition to notifying the primary provider, it also notified care team members such as medical assistants. This facilitates team-based care, allows medical assistants to proactively obtain specimens and provides the possibility of having medical assistants place chlamydia screening orders per protocol.

The electronic medical record system at this FQHC transitioned from Cerner® to EPIC® and the functionality was activated as part of the transition to the EPIC® platform. In its primary implementation the notification was listed on the front page of the patient chart as a hyperlink entitled "Healthcare Maintenance". This link appears in the chart when healthcare maintenance is due on the patient. By clicking on the link providers are taken to a page where a comprehensive list of applicable healthcare maintenance is provided. When no healthcare maintenance is due the hyperlink is not provided. Examples of other comprehensive healthcare maintenance that may be listed include alcohol abuse screening, breast cancer screening, cervical cancer screening, cholesterol screening, diabetes screening, depression screening, influenza vaccine, pneumococcal vaccine, TDAP vaccine, varicella zoster vaccine, and many more.

Establishing appropriate follow-up is an important component for effective chlamydia screening and treatment. Provided that screening results are negative, a telephone-based or email

notification would be appropriate. Care must be taken to avoid leaving voice messages with medical information (including test results) as this might violate HIPAA, thus voicemails should have a standardized message asking for a return call. In the case that screening identifies a positive test result (presence of infection), a follow-up appointment should be made with a tele-health appoint being a viable option. This appointment serves to notify the patient of the positive test results, educate on pathology of disease as well as treatment, ordering of appropriate treatment for the patient as well as sexual partner, and scheduling a follow up appointment in three months to ensure reinfection does not occur.

We established that all female patients aged 24 and younger have annual reminders provided to the primary care providers for chlamydia screening. Thus, the proposed intervention is an electronic notification reminder within the electronic medical record system. The current standard is no electronic reminder, where providers are tasked with manually looking up if patients in this targeted population are due for screening.

SWOT Analysis

At the time of the needs assessment the primary care clinic was transitioning electronic medical record systems, from Cerner® to EPIC®. As such, one of the strengths of this project is that it was very easy to implement and required only management buy-in for the electronic notification system to be an activated feature on roll-out. The leveraging and use of enhanced technology to improve efficiencies of care within a primary care setting is also a strength of this project. Finally, the staff at this clinical site has a good amount of experience, with low attrition rate, and this consistency and established teamwork will strengthen the success of this project.

Weaknesses in the project include the need for additional time within a busy primary care setting where appointments are normally 15 minutes in length and great efforts already exist to

avoid running behind on appointment schedules. Corporate policies within a primary care clinic setting can help to establish standards of care and prevent harm but also serve to limit adaptability within a quickly changing environment and can potentially weaken the long-term impact of this project. There are many different types of screening for different populations within a primary care setting, and transitioning to a new notification system will activate all notifications, thus providers will initially be inundated with potentially multiple screening notifications for each patient. This can result in notification fatigue which may increase the chances providers will initially ignore notifications and this will serve to weaken the project.

Opportunities refer to external influences that can benefit, or be benefitted by the project. An area of opportunity with this project is the increasing education and dissemination of knowledge regarding chlamydia screening, testing, and treatment. As the site of the project is a multi-center non-profit organization there is the opportunity for business development through increased reimbursement by expanding the project throughout the organization. There is also the opportunity for business development as the components of the project bundle can be readily adapted to improve other screening needs. Examples of this might include depression, smoking, obesity, HIV, etc.

Threats to the project can come from social and cultural influences in the community, as patients may see chlamydia screening at taboo, be uncertain how to talk about it with family or partners, and may choose to avoid the matter all-together. The political and economic landscape includes former President Trump policy and funding changes to reduce healthcare coverage for underserved populations which threatens the sustainability of the project. The current healthcare focus is on the Covid-19 pandemic which has resulted in the increase of tele-health visits with a

decreased number of in-clinic appointments, which threatens the impact of this project. A summary and graphic representation of the SWOT analysis can be found in Appendix B.

Cost Benefit Analysis and Return on Investment (ROI)

The Centers for Disease Control and Prevention state the direct medical cost for chlamydia, including diagnosis and treating chlamydia-associated infertility, are estimated at $701 million annually (CDC, 2011). Given that the majority of infections are asymptomatic, establishing a cost benefit analysis relies on a combination of data and estimates, and data on the topic is limited. First, not every case of chlamydia infection will result in comorbidity. According to Herzog et al., (2012) the estimated fraction of chlamydia infected women that develop into pelvic inflammatory disease is 10% (95% CI, 7-13%). Second, a value needs to be associated with each case of PID. Based on research by Chesson, Collins, & Koski, (2008) the average medical costs of each case of PID were $1,995, which included the costs of care for acute PID and costs associated with sequelae such as chronic pelvic pain, ectopic pregnancy, and infertility. Finally, data is required on the incidence of chlamydia within the United States. According to the Centers for Disease Control and Prevention, in 2018 there 1,758,668 reported cases of chlamydia in the U.S. but an estimated 2.86 million infections occur annually (CDC, 2016). Assuming females account for 50% of the population there would be 1.43 million infections that occur annually in females. With PID occurring in 10% of these 1.43 million annual infections, the incidence of PID resulting from chlamydia results in 143,000 cases annually. As the cost of each case of PID is estimated at $1,995, and the incidence is 143,000, the net cost of failing to screen for chlamydia is estimated to be in excess of $285 million dollars annually.

The Fruitvale neighborhood of Oakland California lies within Alameda County and has total population of 50,294 (Wikipedia, 2021). Assuming 50% of the population is female it can be estimated that approximately 25,147 females live within the community surrounding Native American Health Center. According to Healthy Alameda County website, a source of population data and community health information provided by the Alameda County Public Health Department, the prevalence of chlamydia within the county is 584.5 per 100,000 people (2019). Therefore, an estimated 147 cases of chlamydia occur annually in females living within the community surrounding NAHC. As PID occurs in 10% of these 147 cases, and a cost of $1,995 per case to treat, an estimated total cost of treating PID in this community can be calculated as $29,326.50 per year (Appendix I).

There are no direct financial up-front costs associated with CSIP. Secondary costs include the cost of time for developing educational material, surveys, project oversight, and compensating staff for completing education and survey time. At a rate of $60 per hour (typical clinic physician rate) and an estimated time of 16 hours for development, secondary costs are estimated to be $960. Estimating six physicians at $60 per hour and six medical assistants at $30 per hour, and a total of 30 minutes for education and survey, the total lost costs in time are estimated to be $5,400. Thus, total project costs are estimated to be $6,360.

GANTT Chart Narrative

A GANTT chart (Appendix E) was used to outline the workflow and milestones for CSIP. The total project length was 18 months from the initial need's assessment, illustrated in the GANTT chart, and began upon approval of the stakeholders. Pre-intervention data was pulled from the prior 12-month period and referenced while research is conducted and the electronic notification component of the project is implemented. After a 12-month period data was pulled

again and reviewed to assess the impact of the electronic notification. A pre-education survey was developed and distributed to assess a baseline level of knowledge and confidence by clinic staff. The educational component of CSIP was then developed and provided to all staff members. The process of development, distribution, and completion of the education component took approximately 4 months. A post-education survey was then distributed to assess the post-education level of knowledge and confidence by clinic staff. Once the survey was completed, data was pulled again and reviewed to assess the impact of the electronic notification in combination with the educational piece of the project. Finally, a post-project debriefing was conducted to review results of the data, assess the impact of the project on overall screening rates, and provide an opportunity for feedback, evaluation, and improvements.

Outcome Measures

The primary outcome for this project is an increase in chlamydia screening rates for sexually active females aged 24 years old and younger from 14% to 60%. Baseline data was from the previous EMR that included a review of the targeted patients by age seen over the time period from May 2018 through May 2019, and compared to the total number of orders for chlamydia screening over the same time period. After implementing the interventions, screening rate data was analyzed through the EPIC® EMR system over a one-year period, from May 2019 through May 2020. Data reflecting screening rates to identify how the use of reminders built within the electronic medical record system affected screening rates.

Secondary outcomes were measured include provider increase in knowledge, comfort, and ease of enacting chlamydia screening. A general review of the process including workflow and response was analyzed. Lastly, identification of possible barriers to increasing screening rates was reviewed through this intervention.

Analysis Methods

Analyzing the effects of this project on screening rates for chlamydia consisted of a comprehensive review that included 1) assessing care team understanding and knowledge of chlamydia, 2) evaluating providers response to the protocol, 3) evaluating rates of testing, 4) evaluating the identification of infection caught through screening, 5) and performing a secondary analysis of why patients did not complete testing.

A pre and post knowledge survey was used to assess the care team's knowledge and comfort level surrounding chlamydia screening. Post project provider satisfaction with the workflow and intervention was assessed to distinguish any issues. The care team included medical assistants (MA's) who served to provide initial contact with the patient, provide specimen collection kits to patients, facilitate initial questions regarding screening, and provide discharge instructions which include ensuring all questions have been answered. The survey was provided to assess knowledge and comfort pre and post intervention, and served as valuable information for assessing the educational component of the protocol.

A survey was also used to assess providers satisfaction with implementation of the project protocol. Primary care providers are responsible for ordering screening tests, making the recommendation for screening, addressing patient concerns surrounding screening, educating on the details of infection as well as answering all patient questions. The CSIP addressed gaps in knowledge as well as inspired confidence with initiating conversation and enable the recommended screening for high-risk patients. Results from this survey were used to assess the impact of the educational component of this protocol. In addition, it provided subjective input as to the implementation of the electronic notification used within the protocol.

Data reports were available via software that were generated from the two electronic medical record systems used, one pre and one post intervention, that identified patients being screen for chlamydia. These data included filters for female patients, aged 13 to 24 years, with chlamydia testing performed as either urine, vaginal, or cervical, being performed over the one-year periods specified, including any provider, and occurring at the clinic location. The search criteria identified the targeted population, established the total population, determined if each patient had an annual chlamydia screening performed, and a percentage of the total target population who had screening completed could be calculated.

Reports were also available via software than be generated from the two electronic medical record systems used, one pre and one post intervention, that identified patients who were found to have a chlamydia infection. These reports included filters for female patients, aged 13 to 24 years, with chlamydia testing performed as either urine, vaginal, or cervical, being performed over the one-year periods specified, who were positive for chlamydia, including any provider, and occurring within the clinic site. The search criteria identified the targeted population, established the total population of those screened, determined which patient had a positive chlamydia test result, and a percentage of the total target population who had positive test results was calculated.

Ethical Considerations

This project is designed to enhance screening rates for chlamydia and this touches on several ethical topics which will be considered here. Such topics include autonomy, beneficence, justice, non-maleficence, and veracity (American Nurses Association, 2015).

Autonomy revolves around maintaining the patient's right to choose what medical care is provided to them. For chlamydia screening it's important to recognize that the patient has the right to choose to not be screened, and while this possibility is in-fact a limitation within this project, it's vital to recognize and support the patient's choice as to what happens to them from a preventative healthcare standpoint.

Beneficence refers to the act of providing a benefit or doing good for the patient. The ethical consideration of beneficence is the basis for this project as improved screening rates can lower infection rates, reduce comorbidities, and benefit the overall health and wellness of the community.

In its broadest sense Justice refers to the idea of people getting what they deserve, and when considered through the lens of morality may also be seen as "what we owe each other". Distributive justice is a subset of justice that applies to distributing goods or services of various kinds to individuals. Improving screening rates for chlamydia is not only a "just" act in that we owe the opportunity for health and wellness to each other but, this project also enhances distributive justice in ensuring that screening opportunities are distributed to underserved and minority populations.

Non-maleficence is the ethical principle that ensures that we "do no harm" to others. When considering non-maleficence, we have to evaluate the risks involved with screening patients for chlamydia. In addition to the risks of physical harm, we also address the risks of psychological, social, and emotional harm. Screening for chlamydia does pose risks for emotional distress stemming from the fear, anxiety, and embarrassment of testing and the possibility of being infected. There is also the risk of social harm, despite great strides in protecting patient privacy, that the patient may share details of testing with family or friends and

how they may be viewed by their support system. It's important to highlight that this patient population includes adolescents and this stage of development emphasizes the acceptance of family and friends.

Veracity is the ethical principle that addresses honesty and truthfulness in communication. Within that healthcare setting, and as it relates to this project, veracity is the comprehensive, accurate, and objective sharing of information as well as ensuring the patient's understanding of that information. As it relates to screening for chlamydia, the consideration of veracity translates to ensuring that this patient population is informed of recommendation for screening, made aware of the risks and benefits, and have all questions answered honestly and based on current evidence.

The University of San Francisco Jesuit values are reflected within CSIP. These values include Cura Personalis (care for the whole person), being people for others, and diversity in all its forms (University of San Francisco, 2021). By striving to identify and prevent disease, we serve to care for the physical person while simultaneously caring for the whole person through commitment to autonomy and respect for individual values. This project has helped to demonstrate a calling to consider, help, and provide a service to everyone. Furthermore, by implementing this project in an underserved area of California, within an FQHC organization, and by providing care to all who need it, we are working to serve the diversity of the community.

Patient confidentiality was honored, participants screening data was anonymous, and all aspects of HIPPA was monitored throughout the CSIP. Both Cerner and EPIC are HIPPA compliant EMR systems and data collected on screening rates did not include patient identification information. All human subject research projects require Institutional Review Board (IRB) review, regardless of funding. The CSIP involved only analysis of data or

specimens and is not a research project, but instead a quality improvement project. The intent of CSIP is to identify and control a problem, or improve a program/service. CSIP is to the benefit of the participant and participants community, the data that was collected was used to assess and improve a problem/program/service, the knowledge collected is not generalized beyond the scope of the activity, and there were no experimental activities conducted, thus CSIP does not constitute a research project and IRB review was not required.

Results

A total of 312 high-risk patients were identified for screening between 6/17/19 and 6/17/20 (referred to as 2020), following the implementation of this project. A review of the same patient population for year prior, between 6/17/18 and 6/17/19 (referred to as 2019), revealed a total of 285 patients. This translates to a 9.4% increase in the total population of high-risk individuals for chlamydia infection, for this location between 2019 and 2020. The number of people screened for chlamydia in 2019 was 40 out of 285 total patients and equals a 14% screening rate. For 2020, the year following the implementation of CSIP, the number of people screened for chlamydia increased to 156 out of 312 total patients and equals a 50% screening rate (Figure 1). This translates to a 256% increase over the prior year. The Pre-Intervention survey was sent out through email on 9/7/2020 and a total of 12 participants completed it. The educational intervention was provided as a PowerPoint Presentation and sent through email to

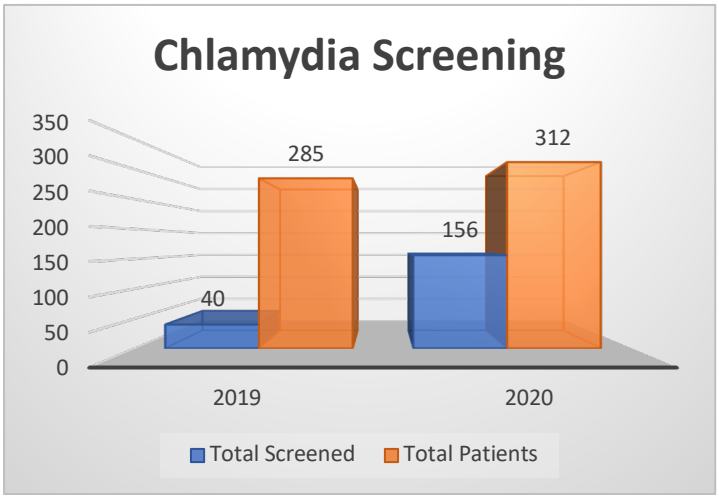


Figure 1 – Screening results

staff on 9/23/2020. A total of 6 participants completed the post-Intervention survey which was provided on 9/30/2020. There were 7 questions in the survey, a Likert scale was used to quantify data, the value of 1 representing a strong positive response and 5 representing a strong negative response (Appendix J). Thus, data with a mean value closer to 1 equates to more confidence and knowledge in the area, while a mean value closer to 5 reflects low confidence and knowledge. The Standard Deviation refers to the variability of the distribution of data. Thus, a Standard Deviation closer to 0 indicates everyone answered very similarly, while a higher standard deviation indicates participants had great variability in their answers. The same questions were used for both the pre- and post-analysis.

Table 1 – Education Pre- and Post- Survey Data

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I am comfortable discussing chlamydia with a patient	1.50	0.50	1.50	0.50
I know what the most common symptoms of chlamydia are	1.83	0.90	1.50	0.50
I can identify the high-risk population for chlamydia infection	2.17	0.99	2.00	1.41
I am aware of who should be screened for chlamydia regularly	1.67	1.11	2.00	1.41
I understand how to test for chlamydia	1.42	1.11	1.33	0.47
I know how to treat chlamydia infection	1.83	1.14	1.33	0.47
I understand how to address sexual partners and testing for cure	1.92	0.95	1.83	0.69

Results of survey data are summarized in Table 1 and reveal that prior to the education module staff members were on average most comfortable with the topics of how to test for chlamydia (mean=1.42) followed by being comfortable discussing chlamydia with a patient (mean=1.50). After the education module was completed, survey data shows that providers

remained most comfortable with the topic of how to test for chlamydia (mean=1.33), but now also includes how to treat chlamydia infection (mean=1.33). The pre-survey questions with the least confidence included identifying high risk populations (mean=2.17) followed by addressing sexual partners and testing for cure (mean=1.92). After the education module was completed survey data revealed that staff members continued to be least comfortable with the questions of identifying high-risk population for chlamydia screening (mean=2.00), in addition to identifying who should be screened regularly (mean=2.00).

The education module was created using a PowerPoint format and was developed to share current knowledge as well as reinforce understanding of the different aspects of chlamydia care, including symptoms, screening, and treatment modalities. Objectives for the module included that by the end of the module participants would be able to describe what chlamydia infection is, explain typical symptoms, identify high-risk populations, describe guidelines for screening/testing, understand current methods for screening, explain how treatment is provided, and identify special considerations of care. Information was provided from the Centers for Disease Control and Prevention as well as several evidence-based research articles, with one slide dedicated for expanding on each of the objectives. The intent of the information was to be clear and concise, and contained 11 slides in total. As a result of Covid-19 and the shelter-in-place order, the intended plan for in-person education had to be modified to a remote learning format. The education content was converted to an Adobe PDF file to facilitate ease of web browser viewing, and provided to the organization. The organization emailed all providers and when providing the email introduced the project, providing the pre-survey link, the education component as an attachment, and the post-survey link.

The survey questions were designed to elicit understanding and confidence levels for each of the areas of the education module. Questions are unchanged between the pre- and post-survey in order to directly compare the effects of the education intervention on the providers. Each question is reviewed in greater detail and the results are interpreted for impact and effectiveness.

Question 1 – I am comfortable discussing chlamydia with a patient.

The first question gauges general overall comfort level for providers while discussing the topic of chlamydia with patients.

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I am comfortable discussing chlamydia with a patient	1.50	0.50	1.50	0.50

The mean score was 1.5 for the pre-survey with 6 providers (50%) stating they felt "very comfortable" discussing chlamydia with patients and 6 providers (50%) stating they felt "somewhat comfortable". The post-survey mean score was also 1.5, with 3 providers (50%) stating they felt "very comfortable" discussing chlamydia with patients and 3 providers (50%) stating they felt "somewhat comfortable". The standard deviation of 0.50 for both pre- and post-survey demonstrate low variability and high consistency in the answers. The information from this survey questions suggests that providers are comfortable with talking about the subject of chlamydia with their patients, and that the education module had no impact on the provider's level of comfort.

Question 2 – I know what the most common symptoms of chlamydia are.

The second question queries knowledge regarding what the most common symptoms of chlamydia a patient would experience. Research indicates that most chlamydia infections have

no symptoms, and for those that do have symptoms the most common symptoms are vaginal discharge and a burning sensation when urinating.

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I know what the most common symptoms of chlamydia are	1.83	0.90	1.50	0.50

The second question asks about how well they know the most common symptoms of chlamydia. The mean score was 1.83 on the pre-survey with 5 providers (41.67%) stating they "strongly agree", 5 providers (41.67%) stating they "somewhat agree", 1 provider (8.33%) stating "neither agree or disagree" and 1 provider (8.33%) stating "somewhat disagree". The mean score was 1.50 on the post-survey with 3 providers (50%) stating they "strongly agree" and 3 providers (50%) stating they "somewhat agree". The standard deviation of 0.90 in the pre-survey, lowering to 0.50 in the post-survey suggests that there was a higher variability in knowledge levels but the education module resulted in knowledge of common symptoms becoming much more consistent. This survey data suggests that the education module helped to improve understanding of common symptoms of chlamydia. However, it's also possible that the 2 participants who provided low confidence in the pre-survey may not have completed the post-survey.

Question 3 – I can identify the high-risk population for chlamydia infection.

The third question asks how well the provider can identify high-risk populations for chlamydia infection. Research shows that the most high-risk populations for chlamydia infection are sexually active females aged 13 to 24 years old.

Survey Questions	Pre-Survey Data	Post-Survey Data

	Mean	Standard Deviation	Mean	Standard Deviation
I can identify the high-risk population for chlamydia infection	2.17	0.99	2.00	1.41

The mean score was 2.17 on the pre-survey with 2 providers (16.67%) who "strongly agree", 8 providers (66.67%) who "somewhat agree", 1 provider (8.33%) who "neither agree or disagree", and 1 provider (8.33%) who "strongly disagree". The mean score was 2.00 on post-survey with 3 providers (50%) who "strongly agree", 2 providers (33.33%) who "somewhat agree", and 1 provider (16.67%) who "strongly disagree". The standard deviation of 0.99 on pre-survey, increasing to 1.41 on post-survey indicates that participant answers became less consistent after the education. Survey data suggests that providers are not as comfortable with identifying high-risk populations for chlamydia as they are with discussing chlamydia. As the number of providers who "strongly agree" rose in the post-survey, from 2 to 3, it further suggests that there was improvement in knowledge from the education. However, the same number of providers who "strongly disagree" continued to strongly disagree after the education module. This may suggest that providers had questions about the information, did not understand the information, or did not agree with the information.

Question 4 – I am aware of who should be screened for chlamydia regularly.

The fourth question asks how well providers know who should be screened for chlamydia on a regular basis. Research demonstrates that the high-risk population is the group who should be screened regularly for chlamydia.

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I am aware of who should be screened for chlamydia regularly	1.67	1.11	2.00	1.41

The mean score was 1.67 on the pre-survey with 8 providers (66.67%) who "strongly agree", 2 providers (16.67%) who "somewhat agree", and 2 providers (16.67%) who "somewhat disagree". On post-survey, the mean score was 2.00 with 3 providers (50%) who "strongly agree", 2 providers (33.33%) who "somewhat agree", and 1 provider (16.67%) who "strongly disagree". Standard deviation rose from 1.11 to 1.41 in the post-survey indicating that not only did providers feel less comfortable knowing who should be screened for chlamydia, they were also less consistent with their self-assessments. This question resulted in a worsening mean score after the education module, suggesting that the education module either confused providers or they disagreed with the information. Likely, the lower score is partially caused by the lower overall number of providers reporting, in combination with 1 provider who reported feeling less confident about who should be screening for chlamydia then before the education.

Question 5 – I understand how to test for chlamydia.

The fifth question gauges how well providers know what the testing options are when screening or testing for chlamydia. Research demonstrates that the best method to test for chlamydia is a urine sample using the first part of the urine (first catch urine).

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I understand how to test for chlamydia	1.42	1.11	1.33	0.47

The mean score was 1.42 on the pre-survey with 10 providers (83.33%) who "strongly agree", 1 provider (8.33%) who "somewhat agree", and 1 provider (8.33%) who "strongly disagree". On post-survey, the mean score was 1.33 with 4 providers (66.67%) who "strongly agree", and 2 providers (33.33%) who "somewhat agree". This question resulted in an improved

mean score suggesting the education module helped increase providers knowledge and comfort level with testing options for chlamydia screening. Standard deviation improved from 1.11 on the pre-survey to 0.47 on the post-survey, indicating participants were also more consistent with their knowledge and level of comfort regarding chlamydia testing.

Question 6 – I know how to treat chlamydia infection.

The sixth question evaluates how well providers know how to treat chlamydia infection. Research demonstrates that the standard treatment for chlamydia consists of a one-time dose of azithromycin at a dose of 1 gram.

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I know how to treat chlamydia infection	1.83	1.14	1.33	0.47

The mean score was 1.83 on pre-survey with 6 providers (50%) who "strongly agree", 4 providers (33.33%) who "somewhat agree", 1 provider (8.33%) who "neither agree or disagree", and 1 provider (8.33%) who "strongly disagree". On post-survey the mean score was 1.33 with 4 providers (66.67%) who "strongly agree" and 2 providers (33.33%) who "somewhat agree". This question resulted in an improved mean score suggesting the education module helped increase provider knowledge and comfort level with how to treat chlamydia infection. Standard deviation improved from 1.14 on the pre-survey to 0.47 on the post survey indicated providers were also more consistently comfortable with knowing how to properly treat chlamydia infection.

Question 7 – I understand how to address sexual partners and testing for cure.

The seventh question evaluates provider knowledge related to medically supporting sexual partners as well as how/when a provider would test to confirm the infection is cured. Research demonstrates that the providers may order treatment for sexual partners without an office visit, that patient and partner should refrain from sex for 7 days after treatment, and that because the rate of reinfection is so high retesting should occur after 3 months.

Survey Questions	Pre-Survey Data		Post-Survey Data	
	Mean	Standard Deviation	Mean	Standard Deviation
I understand how to address sexual partners and testing for cure	1.92	0.95	1.83	0.69

The mean score was 1.92 on pre-survey with 5 providers (41.67%) who "strongly agree", 4 providers (33.33%) who "somewhat agree", 2 providers (16.67%) who "neither agree nor disagree", and 1 provider (8.33%) who "somewhat disagree". On post-survey the mean score was 1.83 with 2 providers (33.33%) who "strongly agree", 3 providers (50%) who "somewhat agree", and 1 provider (16.67%) who "neither agree nor disagree". This question resulted in improved mean score suggesting the education module helped increase provider knowledge and comfort level with addressing the sexual partners of patients with chlamydia infection as well as testing for cure. Standard deviation also improved from 0.95 on the pre-survey to 0.69 on the post-survey indicated providers felt more consistent in their knowledge and understanding of how to address sexual partners and chlamydia retesting.

For this project the electronic notification system had a strong effect on screening rates over the one-year period, resulting in an increase from 14% to 50%. Konerman et al. (2017) implemented a similar notification system in order to screen for Hepatitis C in high-risk populations and demonstrated an increase from 7.6% to 72% over a one-year period.

Furthermore, Tapp et al. (2020) incorporated a notification system within a large healthcare system, including 12 primary care practices, and saw increases in screening rates for both Hepatitis C (3.2% to 22.7%) as well as HIV (6.2% to 11.3%). The utilization of electronic notification systems in the literature has consistently shown beneficial results and the use of this intervention to address chlamydia screening demonstrated similar and significant positive results.

The goal of this project was to increase screening rates to at least 60% and there are several potential reasons for not reaching this goal. The goal was broken down to consist of 50% coming as a result of the electronic notification system and 10% coming from the educational component; a review of the educational survey data demonstrates minimal to no effect in chlamydia knowledge for providers which suggests the educational intervention or the survey methods needs review and improvement. The electronic notification system was activated at the same time as a number of other screening notifications, potentially resulting in something which can be referred to as notification overload. During implementation of EPIC, previous screening and vaccination information was not incorporated, leaving providers inundated and requiring manually addressing multiple screening notifications for each and every patient. As patients often come with a primary complaint, providers are often faced with the option of cancelling the reminder and foregoing the appropriate screening test. This can happen for a number of reasons; providers may be running behind schedule, the patient may have several complaints or be a complex patient, or the provider may just prioritize one of screening needs (i.e., depression). Thus, future projects might benefit by addressing notification overload such as allocating resources to ensure screening and vaccination data is imported from previous EMRs, manually entered and updated prior to activation, or giving providers the option to reset the notification so that it notifies them again at the next appointment.

Discussion

Despite a review of national data that shows screening for chlamydia in the high-risk population is occurring at a rate of approximately 50%, an assessment performed at an FQHC providing primary care to underserved populations in California demonstrated screening rates to be at 14%. During project research and development, the incorporation of an electronical notification system within the medical record was identified as a useful method to bring screening rates close to national averages, while the inclusion of knowledge sharing and education strongly suggested that screening rates could be boosted at least temporarily above national averages. Thus, the aim of this project was to improve screening rates for chlamydia in high-risk populations from 14% to at least 60% within a 12-month period, and as this project resulted in an overall increase of 50%, we did not successfully achieve our goal.

Key findings from this project included that the incorporation of an electronic notification system resulted in significant increases to screening rates, independent of supportive activities such as education modules, collecting surveys, and raising awareness. This aspect of the intervention contributed most importantly to the success of the overall change seen in this project. An unexpected and key finding came from the survey data which demonstrated areas of minimal improvements to knowledge and confidence. More surprising was that one of the questions, related to identifying who should be screened for chlamydia regularly (i.e., identifying high-risk populations), resulted in less knowledge and lower confidence after the education. We assume that these results occurred as a result of education material that was not presented in a clear and concise manner, without follow-up, discussion, or question and answer. Staff likely had preconceived notions, misinformation, or questions regarding high-risk populations for chlamydia screening, and the education module did not provide enough information.

Anecdotally, it was observed that a type of notification overload was occurring during the project and this was neither considered or prepared for. Numerous electronic notifications were activated simultaneously upon software release as the incorporation of screening history into the new EMR never occurred. Therefore, each patient arriving in clinic would have an average of 6 electronic notifications including depression, smoking, and obesity. To resolve this properly the provider would have to open the old charting system alongside the new system, evaluate each notification and update the new system accordingly. The issue of notification overload could have been avoided through the incorporation of historic screening information into the new EMR or through the organization's establishing each patient's initial visit after implementation of the EMR as a 30-minute visit to provide ample time for providers to update charts manually in real-time.

An important implication from this project for the advanced nursing practice is that routinely assessing organizational outcomes can help identify gaps in care, and can reveal opportunities to improve patient outcomes. This project began through a need's assessment, where data on a number of communicable diseases was assessed and compared against guidelines as well as national averages. An additional implication is that the use of a notification system within the electronic medical record has benefit that translates beyond chlamydia and can be incorporated for any number of evolving and currently identified screening criteria. This solution could also benefit other recommended screening guidelines such as obesity, depression, other sexually transmitted infections, and cancer as well as to remind providers about recommended vaccinations. Such a system could be centrally updated to reflect changes in any of the guidelines, such as the American Cancer Society's recent change for colorectal cancer

screening in men, to lower the age for screening to begin at 45 years old (American Cancer Society, 2021).

Providing an educational component for staff member, including chlamydia knowledge, screening guidelines, and treatment modalities can be beneficial for raising awareness and keeping staff updated of potentially evolving changes in the standards of practice. Results from this project's survey data shows that the educational component of this project had a minimal and potentially negative impact on improving self-reported provider knowledge or confidence in certain aspects of screening and treating this population.

The use of an electronic notification system in combination with staff education has been suggested in literature as an effective method for raising awareness while increasing screening rates for a number of diseases within the primary care setting. This solution was incorporated, modified for fit, form and function, and implemented within a primary care setting to enhance chlamydia screening. The results of this project demonstrate that screening rates can be significantly increased by use of this intervention bundle, though staff education and self-confidence was only minimally impacted.

Next steps for this project involve expanding to other clinic sites in order to provide strength to and validate the effects of the intervention. Additionally, the educational component of the project could be reviewed, revised, and re-evaluated utilizing video conferencing or in-person sessions for improved effect.

Interpretations

The purpose of this project was to enhance awareness and knowledge regarding chlamydia, and to implement a solution that will lead to improved screening rates in high-risk populations. Despite survey data suggesting that minimal improvements to chlamydia

knowledge were realized after the educational intervention, an interpretation of the design of the education material as well as the robustness of the survey data collection should be considered. The most successful outcome of this project came from evaluating the percentage of people who are being screened for chlamydia after implementing the intervention. Post-intervention screening rates more than tripled, and now align with national screening rate data suggesting the project was effective.

In evaluating the survey data there is a noted lack of safeguards in place to ensure that access to the post-intervention survey was only available to 1) those who completed the pre-intervention survey and 2) those who watched the educational intervention. While there is no evidence that this occurred, it was possible for new participants, as well as those who did not complete the educational intervention, to access the post-intervention survey and provide data which could have skewed results. To address this shortcoming, a recommendation would be to assign randomized identification numbers to participants, a feature available in the Qualtrics survey software, which validates consistency with participants, allowing for more granularity in the review of data and leading to a better understanding of the true effect of this intervention. Alternatively, the educational intervention could have been completed in person as a presentation and included both a participation sheet as well as a question-and-answer period to reinforce the education. Shelter-in-place orders resulting from Covid-19 would have made this an unlikely solution. Additionally, the lower than anticipated turnout in post-survey respondents (n=6) limits the generalizability of the results.

Limitations

The greatest limitation to this project came about as a result of the Covid-19 pandemic which reached the United States in 2020 and reshaped the primary healthcare landscape.

According to the County of Alameda, shelter-in-place orders were issued to the general public starting March 16, 2020 and had an emphasis on staying at home, leaving only for vital services, and maintaining social distancing (County of Alameda, 2020). Shortly after shelter-in-place order were issued this primary care clinic site was able to incorporate technology for the purpose of facilitating tele-health patient visits. While this allowed for the management of chronic conditions and addressing of new complaints, the ability to facilitate ongoing healthcare screenings is unknown. According to Alexander et al. (2020), primary care visits decreased by 21.4% during the second quarter of 2020. One could infer there were also less labs and screening tests ordered to allow for better focus on patient complaints during this time. As data for the project was collected up through June 2020, a resulting three months of information based on telehealth visits is included, and has likely impacted the results of this project. The significance of this impact is unclear.

An obstacle to the effective rollout of the CSIP was related to notification overload, the large number of notifications within the EMR that occur during the workday, and the impact it would have on the effectiveness of this project. According to a 2016 article in Healthcare IT News, information overload is a concern because new types of notifications can be easily created within the electronic medical record (McCarthy, 2016). As a result, practitioners are experiencing notifications both asynchronously (inbox-like format) and synchronously (pop-up messages) for an increasing number of care related activities, including screenings, vaccinations, test results, response to referrals, requests for medication refills, and messages from other healthcare professionals. Future research would benefit from measuring the impact notification overload has on effective electronic notification as well as systems that may help address it. One approach to addressing this limitation may be having the electronic medical record automatically

enter the appropriate screening order when triggered by electronic notification and allowing the provider to manually cancel the order if the patient chooses to forgo screening.

Perhaps an extenuating condition of the observed notification overload is that practitioners within the primary care setting are not provided additional time or compensation for addressing notifications, with the required time and efforts caused by these notifications not being accounted for. Within the primary care location of this project, the organizational business plan allocates 15-minute time slots for appointments in order to support patient's primary complaint. In addition to addressing primary complaints, providers also perform a review of systems, elicit a medical history, address all pertinent notifications, address any secondary complaints, and answer questions. In practice, providers are becoming more often left to prioritize aspects of care within appointment time frames and the true potential of novel ideas such as electronic notifications could be limited by a lack of time.

Conclusion

Screening for disease in at-risk populations is an effective method to reduce comorbidity and improve health and wellness within the community. However, there are a number of challenges for screening in a busy primary care setting, with additional challenges existing for screening adolescents and young adults. Several organizations have developed evidence-based guidelines that call for annual screening to identify chlamydia infection for sexually active females aged 13 to 24 years old. While organizations strive for 100% screening, data shows that primary care is averaging approximately 50% screening rates nation-wide. Within an FQHC-based primary care clinic site, operating in an underserved area of Oakland CA, screening rates were found to be at 14%. By implementing a bundle that includes an electronic notification

system with education module, screening rates for this high-risk population were shown to improve to 50%, which brings this clinic screening rates in line with the national average.

Funding

In recognition of commitment to care for underserved populations during training and project development at Native American Health Center, an ANEW scholarship was awarded from the Health Resources & Services Administration (HRSA) in the amount of $6,000. The ANEW program supports academic clinical partnerships to educate and prepare primary care nurse practitioners for the unique challenges of transitioning from nursing school to practicing in rural and underserved communities.

References

Alexander, G. C., Tajanlangit, M., Heyward, J., Mansour, O., Qato, D. M., & Stafford, R. S. (2020). Use and content of primary care office-based vs telemedicine care visits during the COVID-19 pandemic in the US. *JAMA Network Open, 3*(10), e2021476. doi:10.1001/jamanetworkopen.2020.21476

American Academy of Family Physicians, (AAFP). (2020). Primary care. Retrieved from https://www.aafp.org/about/policies/all/primary-care.html

American Cancer Society. (2021). When should you start getting screened for colorectal cancer? Retrieved from https://www.cancer.org/latest-news/american-cancer-society-updates-colorectal-cancer-screening-guideline.html

Bitzer, J., Sultan, C., Creatsas, G., & Palacios, S. (2014). Gynecological care in young women: A high-risk period of life. *Gynecological Endocrinology : The Official Journal of the International Society of Gynecological Endocrinology, 30*(8), 542-548. doi:10.3109/09513590.2014.917293 [doi]

Campbell, R. J. (2020). Change management in health care. *Health Care Manager, 39*(2), 50-65. doi:10.1097/HCM.0000000000000290

Centers for Disease Control and Prevention. (2007). Legal status of EPT in California. Retrieved from https://www.cdc.gov/std/ept/legal/california.htm

Centers for Disease Control and Prevention. (2011). CDC grand rounds: Chlamydia prevention: Challenges and strategies for reducing disease burden and sequelae. Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6012a2.htm#:~:text=Both%20clinically%20diagnosed%20PID%20and,structural%20or%20functional%20fallopian%20tube

Centers for Disease Control and Prevention. (2013). Chlamydia screening data, HEDIS and managed care. Retrieved from https://www.cdc.gov/std/chlamydia/hedis.htm

Centers for Disease Control and Prevention. (2015). Reported cases of STDs on the rise in the U.S. Retrieved from https://www.cdc.gov/nchhstp/newsroom/2015/std-surveillance-report-press-release.html

Centers for Disease Control and Prevention. (2016). 2015 sexually transmitted diseases treatment guidelines. Retrieved from https://www.cdc.gov/std/tg2015/qa/chlamydia-qa.htm

Centers for Disease Control and Prevention. (2019). Characteristics of office-based physician visits, 2016. Retrieved from https://www.cdc.gov/nchs/products/databriefs/db331.htm

Centers for Disease Control and Prevention. (2020). Sexually transmitted disease preventive services coverage. Retrieved from https://www.cdc.gov/nchhstp/preventionthroughhealthcare/preventiveservices/std.htm

Chesson, H. W., Collins, D., & Koski, K. (2008). Formulas for estimating the costs averted by sexually transmitted infection (STI) prevention programs in the united states. *Cost Effectiveness and Resource Allocation : C/E, 6*, 10. doi:10.1186/1478-7547-6-10

County of Alameda. (2020). Shelter in place - Alameda County. Retrieved from https://www.acgov.org/documents/Final-Order-to-Shelter-In-Place.pdf

Guy, R. J., Ali, H., Liu, B., Poznanski, S., Ward, J., Donovan, B., . . . Hocking, J. (2011). Efficacy of interventions to increase the uptake of chlamydia screening in primary care: A systematic review. *BMC Infectious Diseases, 11*, 211-211. doi:10.1186/1471-2334-11-211 [doi]

Haley, A., Zimmerman, E., Woolf, S., & Evans, B. (2012). *Neighborhood-level determinants of life expectancy in Oakland, CA.* (). Richmond, Virginia: Retrieved from https://societyhealth.vcu.edu/media/society-health/pdf/PMReport_Alameda.pdf

Healthy Alameda County. (2019). Chlamydia incidence rate. Retrieved from http://www.healthyalamedacounty.org/indicators/index/view?indicatorId=206&localeId=238

Heijne, J. C. M., Althaus, C. L., Herzog, S. A., Kretzschmar, M., & Low, N. (2011). The role of reinfection and partner notification in the efficacy of chlamydia screening programs. *The Journal of Infectious Diseases, 203*(3), 372-377. doi:10.1093/infdis/jiq050

Herzog, S. A., Althaus, C. L., Heijne, J. C. M., Oakeshott, P., Kerry, S., Hay, P., & Low, N. (2012). Timing of progression from chlamydia trachomatis infection to pelvic inflammatory disease: A mathematical modelling study. *BMC Infectious Diseases, 12*(1), 187. doi:10.1186/1471-2334-12-187

Jaworska, N., & MacQueen, G. (2015). Adolescence as a unique developmental period. *Journal of Psychiatry & Neuroscience : JPN, 40*(5), 291-293. doi:10.1503/jpn.150268

Karas, D., Sondike, S., Fitzgibbon, J., Redding, M., & Brown, M. (2018). Using a clinical decision support tool to increase chlamydia screening across a large primary care pediatric network. *Clinical Pediatrics, 57*(14), 1638-1641. doi:10.1177/0009922818803397

Keegan, M. B., Diedrich, J. T., & Peipert, J. F. (2014). Chlamydia trachomatis infection: Screening and management. *Journal of Clinical Outcomes Management : JCOM, 21*(1), 30-38. Retrieved

from https://pubmed.ncbi.nlm.nih.gov/25554725 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4279217/

Konerman, M. A., Thomson, M., Gray, K., Moore, M., Choxi, H., Seif, E., & Lok, A. S. F. (2017). Impact of an electronic health record alert in primary care on increasing hepatitis c screening and curative treatment for baby boomers. *Hepatology (Baltimore, Md.), 66*(6), 1805-1813. doi:10.1002/hep.29362 [doi]

Kong, F. Y., Guy, R. J., Hocking, J. S., Merritt, T., Pirotta, M., Heal, C., . . . Hellard, M. E. (2011). Australian general practitioner chlamydia testing rates among young people. *The Medical Journal of Australia, 194*(5), 249-252. doi:kon10562_fm [pii]

Krist, A. H., Bibbins-Domingo, K., Wolff, T. A., & Mabry-Hernandez, I. (2018). Advancing the methods of the U.S. preventive services task force. *American Journal of Preventive Medicine, 54*(1), S1-S3. doi:10.1016/j.amepre.2017.10.012

Lorch, R., Hocking, J., Temple-Smith, M., Law, M., Yeung, A., Wood, A., . . . Guy, R. (2013). The chlamydia knowledge, awareness and testing practices of australian general practitioners and practice nurses: Survey findings from the australian chlamydia control effectiveness pilot (ACCEPt). *BMC Family Practice, 14*, 169-169. doi:10.1186/1471-2296-14-169 [doi]

McCarthy, J. (2016, EHR notification overload costs doctors an hour a workday, JAMA says. Retrieved from https://www.healthcareitnews.com/news/ehr-notification-overload-costs-doctors-hour-workday-jama-says

McDonagh, L. K., Saunders, J. M., Cassell, J., Curtis, T., Bastaki, H., Hartney, T., & Rait, G. (2018). Application of the COM-B model to barriers and facilitators to chlamydia testing in

general practice for young people and primary care practitioners: A systematic review. *Implementation Science : IS, 13*(1), 130-y. doi:10.1186/s13012-018-0821-y [doi]

McNulty, C. A., Hogan, A. H., Ricketts, E. J., Wallace, L., Oliver, I., Campbell, R., . . . Charlett, A. (2014). Increasing chlamydia screening tests in general practice: A modified zelen prospective cluster randomised controlled trial evaluating a complex intervention based on the theory of planned behaviour. *Sexually Transmitted Infections, 90*(3), 188-194. doi:10.1136/sextrans-2013-051029 [doi]

Menachemi, N., & Collum, T. H. (2011). *Benefits and drawbacks of electronic health record systems* (2011/05/11 ed.) Dove Medical Press. doi:10.2147/RMHP.S12985

Owusu-Edusei, K.,Jr, Chesson, H. W., Leichliter, J. S., Kent, C. K., & Aral, S. O. (2013). The association between racial disparity in income and reported sexually transmitted infections. *American Journal of Public Health, 103*(5), 910-916. doi:10.2105/AJPH.2012.301015 [doi]

Papp, J. R., Schachter, J., Gaydos, C. A., & Pol, B. (2014). Recommendations for the laboratory-based detection of chlamydia trachomatis and neisseria gonorrhoeae--2014. *MMWR. Recommendations and Reports : Morbidity and Mortality Weekly Report. Recommendations and Reports, 63*(RR-02), 1-19. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24622331

Rural Health Information Hub. (2019). Federally qualified health centers (FQHCs) and the health center program. Retrieved from https://www.ruralhealthinfo.org/topics/federally-qualified-health-centers

Scales, P. C., Benson, P. L., Oesterle, S., Hill, K. G., Hawkins, J. D., & Pashak, T. J. (2015). The dimensions of successful young adult development: A conceptual and measurement framework. *Applied Developmental Science, 20*(3), 150-174. doi:10.1080/10888691.2015.1082429

Shannon, C. L., & Klausner, J. D. (2018). The growing epidemic of sexually transmitted infections in adolescents: A neglected population. *Current Opinion in Pediatrics, 30*(1), 137-143. doi:10.1097/MOP.0000000000000578

Tapp, H., Ludden, T., Shade, L., Thomas, J., Mohanan, S., & Leonard, M. (2020). Electronic medical record alert activation increase hepatitis C and HIV screening rates in primary care practices within a large healthcare system. *Preventive Medicine Reports, 17*, 101036. doi:10.1016/j.pmedr.2019.101036

Torrone, E., Papp, J., & Weinstock, H. (2014). *Prevalence of chlamydia trachomatis genital infection among persons aged 14-39 years--united states, 2007-2012*. Atlanta, Georgia: Centers for Disease Control & Prevention (CDC). Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a3.htm

United States Preventive Services Task Force. (2014). Final recommendation statement chlamydia and gonorrhea: Screening. Retrieved from https://www.uspreventiveservicestaskforce.org/uspstf/document/RecommendationStatementFinal/chlamydia-and-gonorrhea-screening

University of San Francisco. (2021). Our values. Retrieved from https://www.usfca.edu/about-usf/who-we-are/our-values

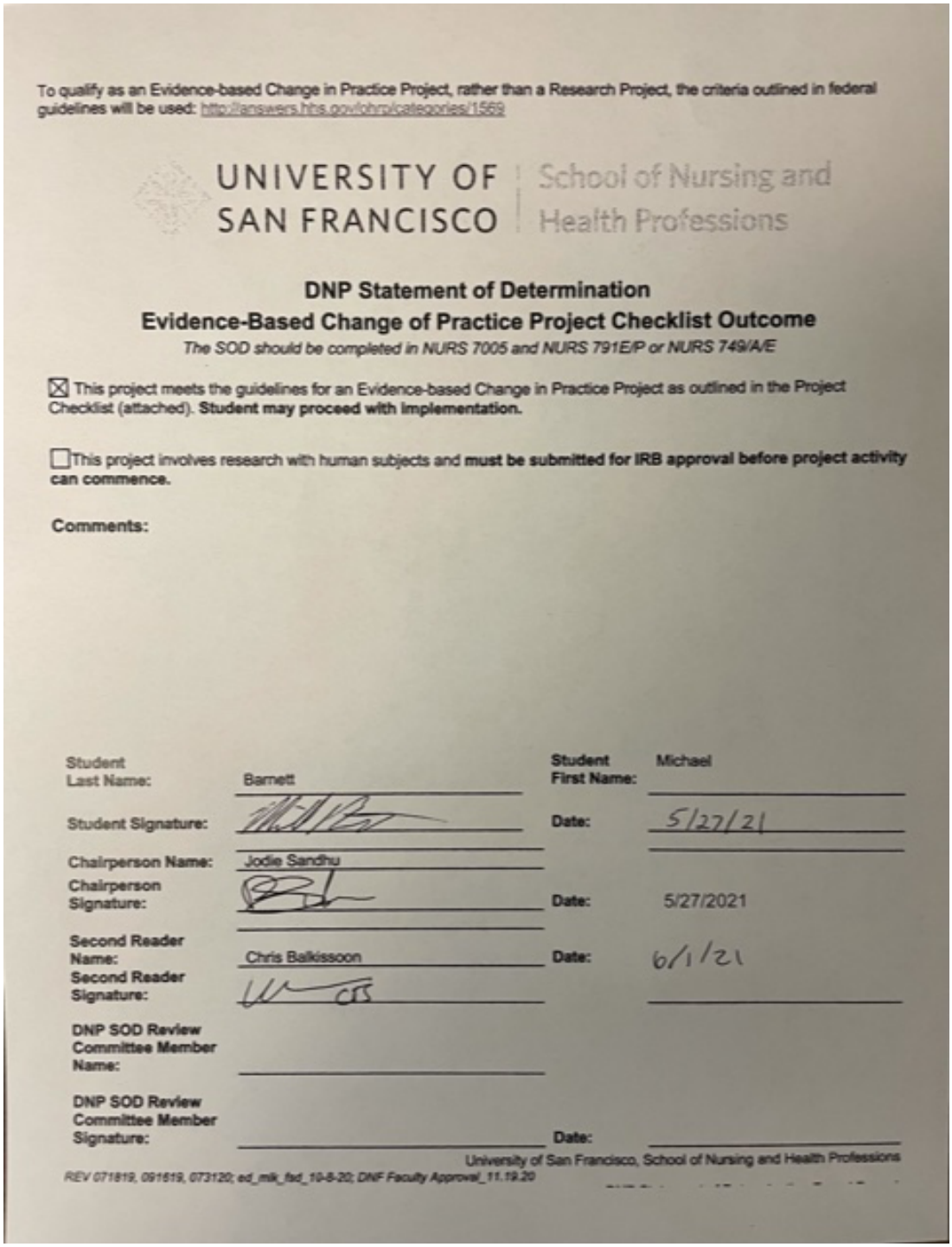
Ursu, A., Greenberg, G., & McKee, M. (2019). Continuous quality improvement methodology: A case study on multidisciplinary collaboration to improve chlamydia screening. *Family Medicine and Community Health, 7*(2), e000085. doi:10.1136/fmch-2018-000085

Wikipedia. (2021). Fruitvale, Oakland, California. Retrieved from https://en.wikipedia.org/wiki/Fruitvale,_Oakland,_California

Wong, W. C. W., Lau, S. T. H., Choi, E. P. H., Tucker, J. D., Fairley, C. K., & Saunders, J. M. (2019). A systematic literature review of reviews on the effectiveness of chlamydia testing. *Epidemiologic Reviews, 41*(1), 168-175. doi:10.1093/epirev/mxz007

Appendix

Appendix A – IRB Non-Research Approval Document



To qualify as an Evidence-based Change in Practice Project, rather than a Research Project, the criteria outlined in federal guidelines will be used: http://answers.hhs.gov/ohrp/categories/1569

UNIVERSITY OF SAN FRANCISCO | School of Nursing and Health Professions

DNP Statement of Determination

Evidence-Based Change of Practice Project Checklist Outcome

The SOD should be completed in NURS 7005 and NURS 791E/P or NURS 749I/A/E

☒ This project meets the guidelines for an Evidence-based Change in Practice Project as outlined in the Project Checklist (attached). **Student may proceed with implementation.**

☐ This project involves research with human subjects and **must be submitted for IRB approval before project activity can commence.**

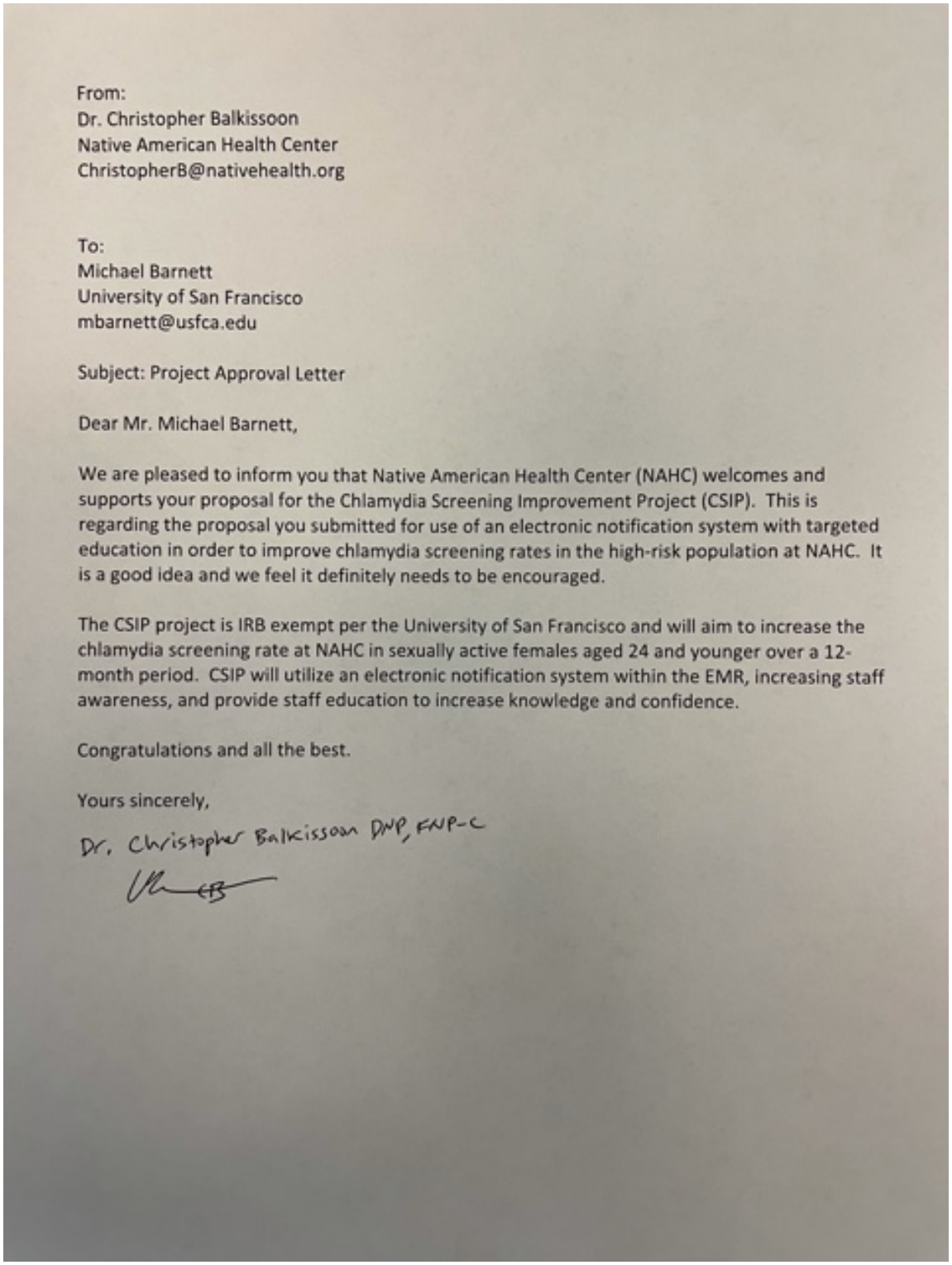
Comments:

Student Last Name:	Barnett	Student First Name:	Michael
Student Signature:		Date:	5/27/21
Chairperson Name:	Jodie Sandhu		
Chairperson Signature:		Date:	5/27/2021
Second Reader Name:	Chris Balkissoon	Date:	6/1/21
Second Reader Signature:			
DNP SOD Review Committee Member Name:			
DNP SOD Review Committee Member Signature:		Date:	

University of San Francisco, School of Nursing and Health Professions

REV 071819, 091619, 073120; ed_mk_fsd_10-8-20; DNP Faculty Approval_11.19.20

Appendix B – Letter of Support from Agency



From:
Dr. Christopher Balkissoon
Native American Health Center
ChristopherB@nativehealth.org

To:
Michael Barnett
University of San Francisco
mbarnett@usfca.edu

Subject: Project Approval Letter

Dear Mr. Michael Barnett,

We are pleased to inform you that Native American Health Center (NAHC) welcomes and supports your proposal for the Chlamydia Screening Improvement Project (CSIP). This is regarding the proposal you submitted for use of an electronic notification system with targeted education in order to improve chlamydia screening rates in the high-risk population at NAHC. It is a good idea and we feel it definitely needs to be encouraged.

The CSIP project is IRB exempt per the University of San Francisco and will aim to increase the chlamydia screening rate at NAHC in sexually active females aged 24 and younger over a 12-month period. CSIP will utilize an electronic notification system within the EMR, increasing staff awareness, and provide staff education to increase knowledge and confidence.

Congratulations and all the best.

Yours sincerely,

Dr. Christopher Balkissoon DNP, FNP-C

Appendix C.1 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
Keegan, M., 2014, Journal of Clinical Outcomes Management, Volume 21, Issue 1, pp 30-38	To review current chlamydia screening recommendations, screening tests, barriers to screening, and management of infection.	Screening – Randomized controlled trial and cluster randomized trial Testing – One analysis comparing different screening strategies. Barriers – One survey and two studies. Management – Two meta-analyses.	Screening – N = 2607 high risk women 1,009 had intervention 1,598 received no intervention N = 17 high school 8 high schools had intervention 9 high schools had no intervention Testing – Cell culture, NAAT, direct immunofluorescence, enzyme immunoassay, and nucleic acid hybridization testing were evaluated. Barriers – Two studies from the Contraceptive CHOICE Project. Management – 2002 meta-analysis as well as CDC recommendations.	Screening – Screening and treatment versus usual care. Schools in the intervention group received the education material and offer for free testing. Testing – sensitivity and specificity Barriers – Not applicable. Management – Other antibiotics including doxycycline, erythromycin, and fluoroquinolones.	Screening – P-value Risk ratio Confidence interval Testing – Sensitivity Specificity Barriers – Risk ratio Confidence interval Management – P-value Confidence interval	Screening – The USPSTF adopted annual screening based on the evidence of these studies. Testing – Use of NAAT technology offers superior sensitivity and allows for vaginal swab and urine testing. Barriers – Included a lack of knowledge and stigma. Treatment – 1 gram of Azithromycin PO once is effective at treating infection.

(RCT = Randomized Controlled Trial, USPSTF = United States Preventative Services Task Force, NAAT = Nucleic Acid Amplification Test, PO = oral administration)

Appendix C.2 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
Guy, R., 2011, BMC Infectious Disease, Volume 11, Article 211, pp 1-13	To provide an updated synthesis of studies examining the efficacy of interventions to improve chlamydia screening.	Systematic review of articles from PubMed, Medline, EMBASE, Cochrane, and Australian New Zealand Clinical Trial Registry Key words included chlamydia, testing or screening, intervention or trial, and general practice or primary care.	96 total articles were identified 81 articles were excluded based on exclusion criteria 15 articles were included for review	Study outcomes included clinic screening rates, total tests done, and mean number of tests per physician.	Six of the 15 articles were significantly associated with increased chlamydia screening at a P-value of 0.05.	Interventions for increasing screening in female population: Multi-faceted quality improvement program. Linking screening to a PAP smear. Integration of computer alerts. Funding for free sexual health visits. An interactive educational workshop. An internet-based education program for doctors promoting screening in high-risk female population.

(PAP = Papanicolaou smear)

Appendix C.3 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
McDonagh, L., 2018, Implementation Science, Volume 13, Article 130, pp 1-19	To identify barriers and facilitators to chlamydia testing for young people in general practice, and to map these onto the COM-B model.	Systematic Review of seven databases including MEDLINE, PubMed, Embase, Informit, Web of Science, PsycINFO, and Scopus. The Capability, Opportunity, Motivation, Behavior (COM-B) is a theory of behavior that can provide insight into chlamydia testing behavior.	Articles from January 2000 through April 2018. Eligible studies had to explore facilitators and/or barriers to chlamydia testing, views toward testing, and/or acceptability of testing in general practice. 39 papers met including criteria 14 focused on patients 25 focused on providers	A standardized framework was used to record aims, methodological characteristics, theoretical framework, main findings, and conclusion of each study. COM-B lies at the center of the Behavior Change Wheel, a toolkit for designing behavior change interventions, and is a starting point for intervention development.	Each paper was assessed using the Critical Appraisal Skills Programme (CASP) by two reviewers. Thematic analysis was performed to identify prominent themes. Identified themes were then classified into six sub-components of the COM-B model.	**Barriers** Lack of knowledge Lack of awareness Forgetfulness Perceived risk Embarrassment Fear Stigma Difficult to discuss No MA/RN involvement Time constraints **Facilitators** Information/education Belief in responsibility Concern for infection Training/use of scripts Alternative modes of testing Involving MA/RN Normalization

(MA = Medical Assistant, RN = Registered Nurse)

Appendix C.4 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
Wong, W., 2019, *Epidemiologic Reviews*, Volume 41, Issue 1, Pages 168 -175,	To evaluate chlamydia screening interventions and address issues related to the heterogeneity of interventions which makes it difficult to determine which are effective.	Systematic Review of databases including PubMed, Cochrane Library, the British Nursing Index, Medical Database, and Sociological Abstracts via ProQuest.	Articles published in English after 2000. Interventions had to focus on chlamydia screening and have one or more of the following outcome measures: number of chlamydia tests, testing rate, retesting rate, and/or treatment rate for chlamydia 200 studies met inclusion criteria 21 reviews were in the final inclusion	Variables include target populations, settings, type of testing, number of people tested, prevalence, number of people treated, effectiveness, and barriers.	A socioecological model was used to organize interventions into categories including interpersonal, organization, community, and policy	**Interpersonal** Home-based self-collection kits **Organizational** Computer alerts for doctors **Community** Screening in educational and detention centers **Policy** Educational package among general practitioners

Appendix C.5 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
McNulty, C., 2013, *Sexually Transmitted Infections*, Volume 90, Issue 3, Pages 188-194	To determine if a structured complex intervention increases chlamydia screening in a general practitioner practice.	A prospective, cluster randomized controlled trial with modified Zelen design. Practices may tend to participate in educational initiatives, making research practice atypical The modified Zelen design overcomes potential bias by not informing any participants that they participating in a trial.	160 different general practice settings in Southwest England between 2009 and 2011. 80 practices to intervention and 80 to control. Intervention is based on the theory of planned behavior consisting of education and practical resources to influence social cognition in staff and increasing testing intention.	The complex intervention includes an outreach educational workshop (presentation) with combination of posters, invitation cards, and electronic reminders.	Aggregate data by month, age and gender for each registered GP on all chlamydia screening tests in the study area were used to assess the absolute and relative change in testing between the intervention, control, and non-study practices.	Testing rates across all practices with the intervention saw an increase from 2.43 to 4.34 per 100 patients, compared to the control group with saw an increase from 2.43 to 3.00 per 100 patients. The complex intervention led to a 76% increase in screening rates across all practices.

(GP = General Practice)

Appendix C.6 – Research Evaluation Table

Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
Karas, D., 2018, *Clinical Pediatrics*, Volume 57, Issue 14, Pages 1638 -1641	To identify the impact of a CDS tool on the screening rates for chlamydia among female patients aged 13 to 21 years presenting in preventative care.	A retrospective review evaluating the impact of pop-up alerts and education on chlamydia screening rates over an 18-month period.	Akron Children's Hospital Pediatrics is a network of 27 pediatric primary care offices in urban, suburban, and rural areas. All practices are linked through a common EHR (EPIC) Participants were females between the ages of 13 and 21 years old.	A pop-up alert to notify providers that a patient was due for screening. An educational component was also developed in conjunction to increase providers awareness of screening recommendations, consisting of two presentations and quarterly newsletters distributed to the medical offices for 2 years	An evaluation of medical record information looking at how many alerts occurred, how many declined screenings, had screening performed at another facility, or consented to screening.	The proportion of screened patients increased from 230 to 561 which represents a 109% increase

(CDS = Clinical Decision Support, EHR = Electronic Health Record)

Appendix C.7 – Research Evaluation Table

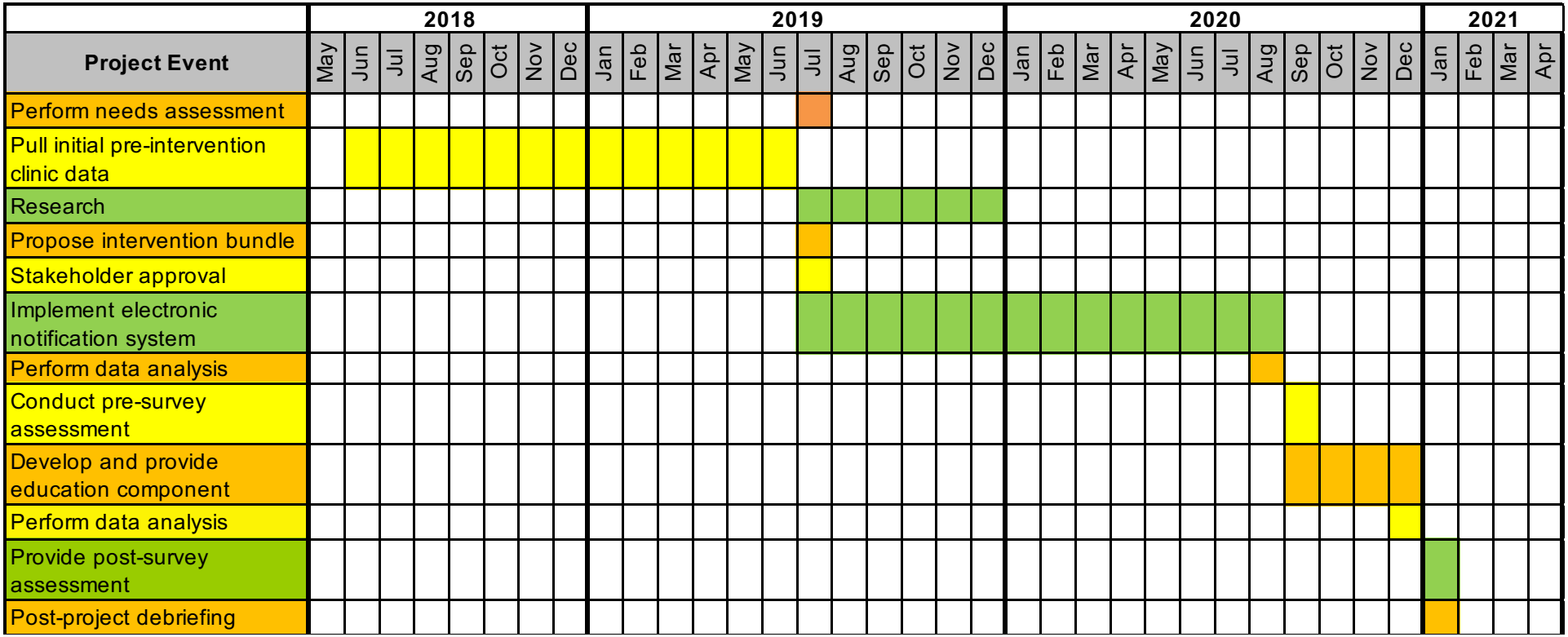
Citation	Aims	Design & Methodology	Sample & Setting	Variable	Measurement & Analysis	Findings
Ursa, A., 2019, *Chinese General Practice,* Volume 22, Issue 25, Pages 3028 - 3034	The aim of this paper is to conduct a case study looking at the use of Plan-Do-Check-Adjust (PDCA) as a framework for quality improvement to improve chlamydia screening in women aged 16 to 24 years old	Plan, Do, Check, Adjust model and the Model for Improvement steps.	Part of a multi-department collaboration (family medicine, internal medicine, pediatrics, obstetrics and gynecology, and the University Health Service) within the University of Michigan Health System, over a one-year period from May 2014 to May 2015. Eligible patients were women aged 16 – 24 who were sexually active.	Education material and a clinical decision support tool within the EHR. The educational material was for staff, patients, and parents that explained the importance of screening, the process of screening, and notification of results and treatment. The clinical decision support tool was an alert that displayed in an area of the EHR called “best practice advisory”.	Data collection included outputs from the EMR as well as interviews with clinicians and staff to understand the current state and challenges of chlamydia screening.	Screening improved from 29% to 60% within 8 months at the pilot clinic site. Four years after the intervention screening rates ranged from 32% - 63% for 16 to 17 years old and 49% - 80% for 18 to 24 years old QI projects benefit from the step-by-step process outlined in the PDCA and Model for Improvement theories to effectively tackle challenges and improve outcomes.

(PDCA = Plan, Do, Check, Adjust, EHR = Electronic Health Record)

Appendix D – Gap Analysis

Chlamydia Screening Improvement Project Gap Analysis		
Current State	**Best Practice**	**Proposed Solution**
Potential lack of staff knowledge regarding aspects of chlamydia screening and treatment, as well as potential lack of confidence to effectively discuss and answer questions with patients	Provide periodic and updated chlamydia education to staff members including screening guidelines, symptoms, treatment, and common questions	Develop education module for staff to teach and update knowledge regarding chlamydia screening and treatment
Cultural and educational barriers to effective chlamydia screening in the clinical setting	Staff to effectively communicate and educate patients, answer questions about, and recommend annual screening for high-risk patients	Create survey for staff members to measure knowledge and confidence in discussing chlamydia in the clinic setting, both pre and post education
Absence of formal system to remind providers of high-risk population and frequency for chlamydia screening	Availability of a convenient and accessible reminder system for staff to identify high-risk populations and chlamydia screening guidelines	Initiate electronic notification/reminder system to alert providers when clinic patients are considered high-risk and due for screening

Appendix E – GANTT Chart

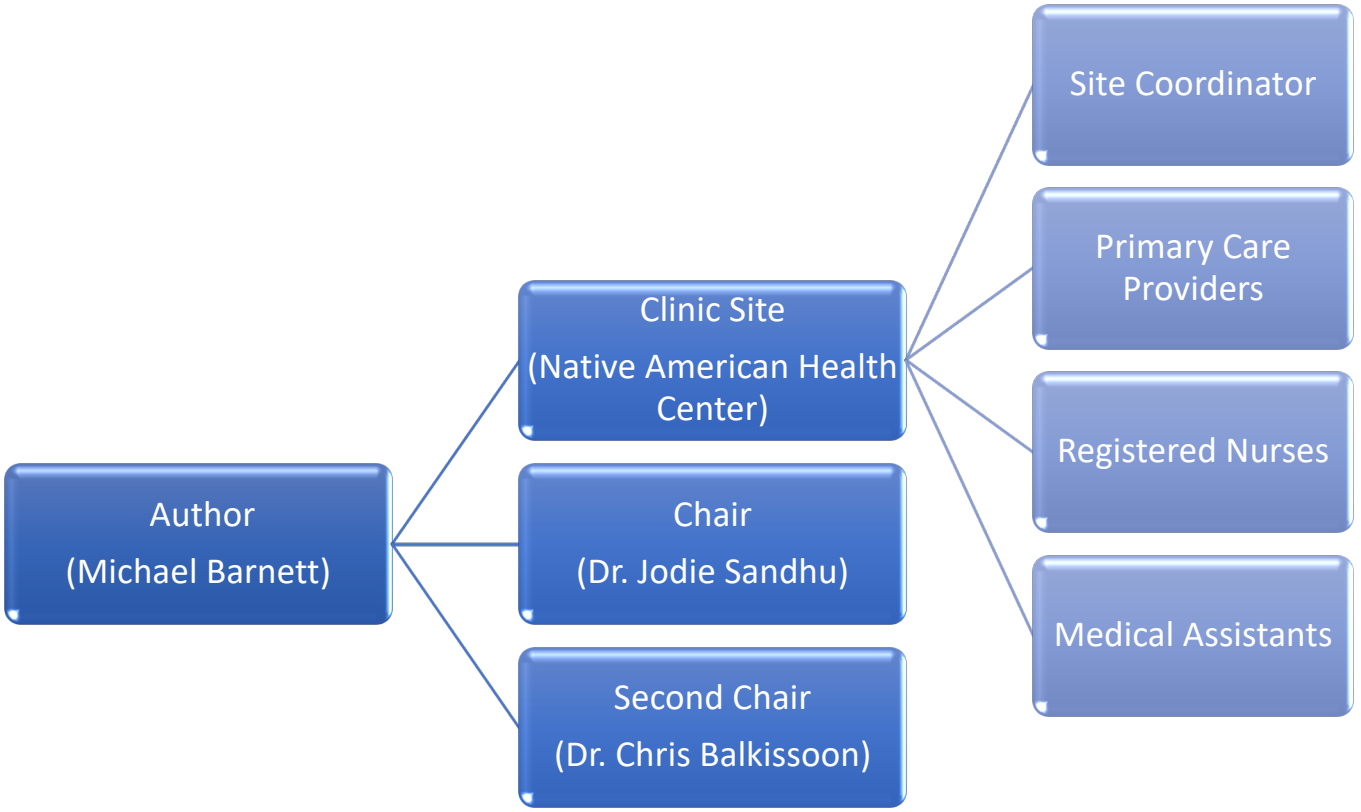


Appendix F – Work Breakdown Structure

Level 1	Level 2	Level 3
1. Chlamydia Screening Improvement Project (CSIP)	1.1 Initiation	1.1.1 Evaluation of Baseline Data & Recommendations 1.1.2 Develop the Business Case 1.1.3 Develop the Project Charter
	1.2 Planning	1.2.1 Create Aim Statement 1.2.2 Determine Project Team 1.2.3 Define Electronic Notification and Test in Virtual "Playground" 1.2.4 Develop Education Module and Survey Material 1.2.5 Develop Project Plan 1.2.6 Project Plan Approval
	1.3 Execution	1.3.1 Project Kickoff Meeting 1.3.2 Implement Software System Upgrade 1.3.3 Evaluate Electronic Notification in Real-Time 1.3.4 Test Report System for Accumulation of Data Verification 1.3.5 Conduct Pre-Survey 1.3.6 User Training / Education 1.3.7 Conduct Post-Survey 1.3.8 Evaluation of Post-Intervention Data
	1.4 Closeout	1.4.1 Project Review Meeting 1.4.2 Document Project Plan with Results and Lessons Learned 1.4.3 Update Files/Records 1.4.4 Gain Formal Acceptance 1.4.5 Archive Files/Documents

Appendix G - SWOT Analysis

Appendix H – Communication Matrix



Appendix I – Cost Analysis

Direct Expense	Projected Cost (-)	Project Savings (+)
Development		
Education Module	$480	
Survey	$480	
Activate electronic reminders	$0	
Training		
Education	$2,700	
Survey	$2,700	
Total Projected Costs	**$6,360**	
Indirect Costs		
Treatment for PID		$1,995
Estimated annual # of cases		147
Total Projected Savings		**$29,326.50**
(Net Cost / Savings)		**+ $22,966.50**

Appendix J – Chlamydia Screening Improvement Project Pre and Post Survey

1. I am comfortable discussing chlamydia with a patient
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

2. I know what the most common symptoms of chlamydia are
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

3. I can identify the high-risk population for chlamydia infection
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

4. I am aware of who should be screened for chlamydia regularly
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

5. I understand how to test for chlamydia
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

6. I know how to treat chlamydia infection
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**

7. I understand how to address sexual partners and testing for cure
   (Strongly Agree) 1 2 3 4 5 **(Strongly Disagree)**